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NOTES ET ACTUALITES

Personalia

Au début de novembre M. G. Court, Chef des Services de Recherches Agricoles de Madagascar, fit un bref séjour à Maurice. M. Court se dévoue tout spécialement à l'amélioration dans la Grande Ile des variétés de riz. Il a emporté de chez nous des boutures de nouvelles variétés de cannes et une petite collection de graines potagères et autres semences aux fins d'essais à Madagascar. Il est plus que probable que nous aurons l'année prochaine la visite du Chef des Services Agricoles de la Réunion. Ces visites interinsulaires sont d'heureux augure à plus d'un titre et contribueront à la création de nouveaux liens entre les îles voisines.

Le Dr. H. Evans, dont nous annoncions le transfert à Trinidad dans le numéro de juillet-août de cette revue, a quitté la colonie le 14 novembre dernier. Le Dr. Evans a été l'objet avant son départ de cordiales manifestations de la part de ses collègues et de ses nombreux amis.

Monsieur le Professeur Raoul Cerighelli, docteur-ès-sciences, professeur d'agronomie tropicale à la Faculté des Sciences de Marseille, a passé une semaine à l'île Maurice à la fin de novembre. Cette visite complète une tournée à Madagascar et la Réunion où M. Cerighelli a présidé aux examens de baccalauréat. Il espère revenir ici l'année prochaine pour un séjour un peu plus prolongé afin de compléter sa documentation sur les cultures tropicales.

A la fin de décembre trois de nos plus anciens administrateurs ont pris leur retraite. Il s'agit de M. Gustave Mancini, administrateur de " The Mount S.E. " depuis trente ans, de M. Raoul Harel, administrateur de Mon Désert-Alma et de M. Loïs Robert, administrateur de Bel Ombre. M. Freddy Robert succède à son père à Bel Ombre. M. Mancini aura pour successeur M. Maxime Rey, tandis que M. Francis North Coombes, administrateur de Rose Belle, succède à M. Harel. M. Coombes était administrateur de Rose Belle depuis 1944, date à laquelle il avait succédé à son père M. Frederick North Coombes. L'administration de Rose Belle a été de nouveau confiée à un fils de M. Frederick North Coombes, Maurice, directeur de l'usine de Beau Plan. On nous permettra d'ajouter que le fils aîné de M. Frederick North Coombes, Lindsay, est administrateur de Flacq United Estates Limited. L'administration simultanée de trois de nos plus beaux biens sucriers par trois fils d'un ancien administrateur, et la succession ininterrompue de trois Coombes à la gérance de Rose Belle constituent, croyons-nous, des faits sans précédent dans les annales de l'industrie sucrière mauricienne. M. Vivian Olivier, directeur de l'usine de Sans Souci qui cessera de fonctionner en 1950, a été choisi pour diriger l'usine de Beau Plan.

« Year Book of Statistics, 1947 »

The second volume of this series was published in September. The first issue, 1946, could not be a complete digest of Mauritian statistics and much additional information of general interest has been incorporated in the present publication. Thus, the migration of population within the island is strikingly brought out. The population of Port Louis has increased by 25% since the end of World War I, chiefly as a result of improvements in, and development of, road transport. There has also been an influx of population into Plaines Wilhems district, which in 1944 had increased by 89% of the original population of 1901. On the other hand, Moka has lost 35% of its inhabitants over the same period. The other districts, except Rivière du Rempart, have lost from 5% to 12 o/o of their original number.

As regards land utilisation generally, 70 o/o of the total area of 460,800 acres, or 324,500 acres, have been assessed as suitable for agriculture and grazing of which the actual arable area is estimated at 210,000 acres. Of this area there were just under 150,000 acres under sugarcane in 1947. Other industrial crops are grown on a much smaller scale ; the area under *Furcraea gigantea*, cultivated and growing wild, may be put at about 7,500 acres, that under tea at 1,985 acres, while tobacco occupied 640 acres, giving a total of about 160,000 acres under industrial crops. The area under food crops and vegetables during the year was estimated at 12,650 acres.

91 o/o of the area under cane was harvested. This high percentage is due to the replanting of land recently under food crpps and to the cultivation of earlier maturing cane varieties, chiefly M 134/32. 28 million tons of canes were obtained from which 348,000 tons of sugar were extracted ; of this total some 19,000 tons were consumed in the island. In 1947, there were 20 estates with factories, while 14,000 planters cultivated 48.3 of the total area under cane. The yield of cane varies of necessity from year to year and from locality to locality. The best cultivated lands showed on the average, in 1947, over 30 tons of millable cane per acre, while the average yield for the whole island over the period 1940-46 was just under 21 tons. The sugar extracted per acre varied from 1.5 to 3.8 tons according to locality and category, the overall average being 2½ tons. On the average, all factories operated for 104 days ; their crushing capacities ranged from 30 to 75 tons of canes per hour. The sugar production in 1947 was the highest on record.

Of the 72,000 tons of molasses obtained, about 50,000 were used in 11 distilleries to produce, in terms mostly of rum and power alcohol, the equivalent of nearly 82,000 hectolitres of 100° G.L. alcohol.

As regards aloe fibre, 23 factories exist but only 11 of them operated during the year to produce 940 tons of fibre, of which 654 tons were

processed in the Sack Factory mostly for the manufacture of sugar bags. 78 tons of raw fibre were exported.

The five tea factories produced 235 tons of made tea. Three of these factories are working to capacity, but the biggest of them is producing only about 45 o/o of its potential annual production of commercial tea.

The production of tobacco is limited to some 400 tons per annum. In 1947, 463 growers produced 343 tons of flue and air-cured leaf from an area of 640 acres.

The cultivation of ground-nut, on a greater scale than ever attempted before in the island, with the object of producing as much as possible of the local requirements of edible oil, covered an area of about 200 acres. This first attempt has not come up to expectation, owing to the susceptibility to bacterial wilt of the seed imported from Uganda, so that the production of unshelled groundnuts in 1947 did not exceed 125 tons.

Le maïs hybride constituerait un danger alimentaire

L'extension qu'a prise la culture de maïs hybride aux Etats-Unis et ailleurs est bien connue. Les semences de maïs hybride donnent de sensibles augmentations de rendement que renforcent encore des doses massives d'engrais chimiques. Ces beaux rendements s'obtiennent malheureusement au détriment de la qualité. Le Dr. William Albrecht, chef du département des sols de l Université de Missouri, a constaté que durant les dix dernières années la teneur en matières protéiques du maïs a baissé de 10.5 pour cent ; elle a en effet passé de 9.5 à 8.5 pour cent. Le Dr. Albrecht attribue cette régression à l'hybridation et aux forts apports d'engrais chimiques azotés.

Il convient de faire ressortir que l'augmentation de rendement du maïs par suite de l'hybridation est due surtout à une plus grande richesse en hydrates de carbone, encore appelés matières hydrocarbonées, c'est-à-dire en matières grasses, en sucres et en amidon. Or, c'est la protéine qui est le facteur le plus important de tout protoplasme vivant. La déficience de protéine résultant de l'hybridation du maïs, ainsi que l'a fait ressortir le Capitaine J. M. Moubray du Sud-Afrique, constitue un grave problème tant dans l'alimentation des indigènes que dans celle du bétail. Le Dr. Baker-Jones considère que cette carence peut avoir des répercussions désastreuses pour l'humanité.

Il y a déjà longtemps que feu Sir Albert Howard, grand partisan de l'usage de compost en agriculture, a poussé le cri d'alarme. Il soutenait que l'apport de matière organique, sous forme de compost ou d'engrais de

ferme, conférait aux plantes le pouvoir de résister aux maladies cryptogamiques et leur assurait une pérennité quasi éternelle. Par contre, l'usage immodéré d'engrais chimiques favorise des effets contraires, et le Dr. Max Greson des Etats-Unis a émis l'opinion que la cause initiale du cancer chez l'homme, ainsi que celle de nombreuses maladies chez les plantes, doit être attribuée à l'usage intensif d'engrais azotés dans la culture des légumes et des fruits et dans la production de fourrage vert. Cela tiendrait a une synthèse imparfaite dans la feuille des engrais azotés.

Du nouveau dans les recherches atomiques

M. P. Sainderighin de " La Voix du Nord " a récemment interviewé le Professeur Boris Pregel. l'un des experts atomiques des Etats-Unis et professeur de la Faculté des Sciences de l'Université Française de New-York. La grande préoccupation des Américains est de tirer parti des substances radio-actives dans le domaine de l'agriculture. Des résultats extraordinaires ont été déjà obtenus au cours d'un très grand nombre d'expériences. Ces expériences ont prouvé que les substances radio-actives, convenablement dosées et correctement utilisées, permettent de doubler, parfois même de tripler, la fertilité du sol. Des betteraves ont eu leur teneur en sucre augmentée de 50 o/o. Des tomates ont pu être récoltées avec trois semaines d'avance sur les tomates non-traitées. Et la récolte en poids est améliorée parfois dans des proportions incroyables : 60 o/o pour les concombres, 40 o/o pour les pommes de terre, et même 90 o/o encore pour les tomates.

L'apport de substances radio-actives ne risquerait pas d'épuiser les sols de culture. Le sol est naturellement radio-actif. Des mesures précises ont démontré, toujours aux Etats-Unis, que le sol de surface est beaucoup moins riche en substances radio-actives que le sous-sol. Il s'est appauvri, et nos traitements, dit le Pr. Pregel, ont pour résultat de le rajeunir. Le professeur ajouta que la flore gigantesque des premiers âges provenait, pour une grande part, outre les conditions du climat, de la richesse radio-active des sols primitifs. Les nouvelles méthodes de cultures, sitôt les expériences confirmées sur une vaste échelle, se répandront très rapidement. Et comme l'agriculture est à la fois la plus vieille et la plus importante industrie du monde, " nous sommes en train de faire un grand pas vers l'abondance."

BUD ROT OF THE ARECA NUT PALM IN MAURITIUS

G. ORIAN

Assistant Plant Pathologist, Department of Agriculture, Mauritius.

Discovery of the disease.

On the same premises in Malartic Street at Rose-Hill, where an outbreak of bud rot occurred on the royal palm (*Roystonea regia* O.F. Cook) in 1944 (1),* three dead areca nut palms (*Areca Catechu* L) were detected by the writer in August, 1947 (phot. 1). His attention had not been drawn earlier to the case because the owner of the property had attributed the death of the trees to the effect of several cyclones experienced in 1945 and 1946. The proximity of the place to that where stood the diseased royal palms, however, prompted the writer to examine carefully the other areca nut plants growing in the row ; as a result, a few discoloured leaflets, with symptoms described below, were observed on the oldest leaf of the otherwise perfectly healthy plant seen in the foreground of the photograph.

In the laboratory, the veins of the affected tissues exuded gum in water under the microscope, in the manner characteristic of palm or sugar cane leaves affected by *Xanthomonas vasculorum* (Cobb) Dowson. That organism, the pathogen of the gumming disease of the sugar cane, has been proved by the writer to exist in Mauritius on two other palms, namely, the white palm (*Dictyosperma album* Wendl. & Drude) (2) and the royal palm (*Roystonea regia* O.F. Cook) (1). The causative bacterium was isolated from the diseased areca leaf tissues and proved to be *X. vasculorum* as was anticipated.

Altogether, only eight diseased leaflets were detected on the leaf mentioned ; they comprised a batch of seven small ones quite near the tip of the leaf and still another one lower down, separated from the first batch by six healthy leaflets. It was evident that the diseased leaflets had long been affected, very likely when the leaf was quite young and just pushing out from the central spindle. The dried tissues towards their tips had become brittle and had fallen off for the most part. Photograph 4 shows one of these leaflets ; none in a better condition was found.

*The numbers between brackets refer to the literature cited at the end of this article.

Symptoms of the disease.

The symptoms which the affected leaflets exhibited differed to some extent from those shown by white palm leaflets attacked by *X. vasculorum*.

On the latter palm, the leaf symptom is characterised by a blight running downwards from the tips and exhibiting various shades from Madder Brown to Liver Brown and Diamine Brown (3), the dying regions being bordered by a diffuse yellow discoloration (2).

On royal palms, attention has been drawn to the fact that no blight has been observed but only a simple wilting and drying (1).

In the case of the areca nut palm, the affected leaflets were observed to have dried out to Pale Drab-Gray from the tips ; but the death of the tissues, which is preceded by a Marguerite Yellow to Naphthalene Yellow discoloration, may occur irregularly in the chlorotic region. Sometimes a very narrow Tawny-Olive border separates the yellow tissues from those in a more advanced stage of attack. The dead and dying regions offer besides a peculiar dappled appearance (phot. 4), never observed on diseased white palm leaves, through the formation of numerous small slightly sunken Snuff Brown patches, sometimes somewhat crescent-shaped in outline.

Examination of areca nut palms in other parts of the island has revealed that the plants show some marked tendency to exhibit a partial chlorosis of the leaflets, but in no case of ordinary drying was the peculiar dappled appearance observed ; this aspect must therefore be considered for the present as one of the symptoms of the disease on the plant.

The veins in the yellow leaf regions are discoloured yellowish-brown, as seen by transmitted light (phot. 4) ,and it was this peculiarity which caught the writer's attention at first. As already said, abundant gum ooze was observed from these vessels when the leaf tissues were examined in water on a slide. Sometimes veins ooze gum which show no noticeable discoloration to the eye ; on the other hand, the vascular bundles in the dried out parts of the leaves also exude gum when placed in water.

Of the three bud-rotted plants mentioned above, of which only the denuded stems remained when first noticed, two had dried right down to the base, but the third was still fresh. Disease had made little progress within, and only a small amount of newly-affected tissue was observed in the region immediately bordering the dead apex. Portions removed from that region oozed but few, minute, dirty gum drops when placed in moist chamber. No gum drops were observed to exude from the vascular bundles in the still sound regions of the stem further down.

Isolation of the pathogen.

On 1.9.47, small portions of the yellow leaf tissues enclosing discoloured bundles were disinfected by the usual method and the cut ends rapidly streaked along the surface of peptone-saccharose agar which had been allowed to solidify in Petri dishes.

On 8.9.47, numerous yellow colonies had developed along the streaks, and six were fished and transferred to agar slants, where they developed into typical *X. vasculorum* growths.

Inoculations on cane.

On 24.9.47, suspensions in sterile water of 20-hr.-old transfers of three of the cultures were used to inoculate M. 55/1182 sugar cane leaves, a variety very susceptible to the gumming disease ; three blades and one spindle being inoculated with each culture. Controls opposite the inoculated *blade* centres were made by puncturing the tissues by numerous light needle pricks through a drop of sterile water ; they were marked by a circle with Indian ink, to distinguish them from the inoculated areas.

On 6.10.47, the early beginnings of stripe formation were observable as short, interrupted, reddened lengths, along the course of some veins up and down from the punctures. On 16.10.47, *characteristic and well-developed gumming disease stripes had been produced from all the blade and spindle inoculations made.*

Photograph 5 shows the stripes produced by one of the cultures labelled Ar_3. That culture was forwarded to the Lister Institute, Elstree, Herts, and was there listed as No. 7419 in the collection of type cultures of the Institute.

Inoculations on maize.

One young maize plant available at the time, was inoculated into the spindle with one of the suspensions on 24.9.47.

On 6.10.47, white veins and pallid-green stripes characteristic of the sugar cane gumming disease symptoms on maize (2) were found present. The plant had not been examined earlier, but it was evident from the number of leaves then seen affected, that the stripes must have been visible for at least a week previously. One of the affected leaves is shown in photograph 6.

Host tissues affected.

Sections of the diseased leaflets indicated that, as is the case with

X. vasculorum infection, the bacterial gum is located within the xylem vessels of the bundles. Through limitation of time, unstained sections in Gurr's mounting medium were photographed ; two of these are shown in photographs 2 and 3.

Discussion

In previous back inoculations with *X. vasculorum* from the white and the royal palms into the respective plants, and in cross inoculations into the various hosts with these isolates and with *X. vasculorum* obtained from the sugar cane, the writer has definitely proved the sugar cane gumming disease organism to be pathogenic to palms (1,2). The bacterium isolated from the areca nut palm, having produced in sugar cane leaves the typical stripes which are specific to *X. vasculorum*, it was considered that it had thereby sufficiently characterised itself and that no suspicion of doubt whatever could be left as to its identity. Owing to pressure of work in other directions, it was in consequence decided that neither back inoculations of the organism into the areca nut palm, nor a laboratory study of its characters was indispensable in the present case, and the researches on the subject were therefore brought to a close.

As pointed out, the material available for study was most meagre, but it sufficed to show that the leaf symptoms produced by *X. vasculorum* may be somewhat different in appearance on different palms.

Attention has also been drawn to the scanty production of gum from the cut vessels of diseased areca nut stems, even in regions almost immediately bordering the apex of the bud-rotted stem. The particular plant which had been examined for the purpose had lost its crown months previously ; yet the disease had visibly progressed but very little down the stem. This contrasts strikinkly with the easy invasion of the vascular tissues of royal palm plants affected by the pathogen. Indeed, in our study of the latter disease (1), we noted that in a tall tree on which the crown leaves had just completely dried out, gum ooze was produced from vessels amidst otherwise perfectly sound ground tissue, as low down as some twenty feet from the rotten cabbage, whilst sections higher up cozed in abundance. This fact indicates most probably that the areca nut palm is much more resistant to the disease in nature than is the royal palm. As already stated (1), the white palm comes next to the royal palm in degree of susceptibility.

Summary

A disease of the betel-nut palm (*Areca Catechu* L.) ending in a bud rot was detected in Mauritius in 1947. The causative organism was proved

Phot. 1 — Dead areca nut palms in Malartic Street, Rose-Hill. Photo 22.9.47.

Phots. 2 and 3 — Transverse sections of *Areca Catechu* leaflets in region enclosing discoloured veins.

Note the blocking of the xylem vessels with gum. Photo. unstained sections on Ilford Empress Plate, 11.11.47.

Phot. 4 — Areca leaflet affected by *Xanthomonas vasculorum*. Natural infection.

Photo. by transmitted light on Ilford Rapid Process Panchromatic Plate, with Ilf. Tri-colour Red filter. (About natural size).

Phot. 5 — Blade (right) and spindle (left) inoculations with the areca nut palm pathogen (Culture Ar_3) on the sugar cane variety M. 55/1182.

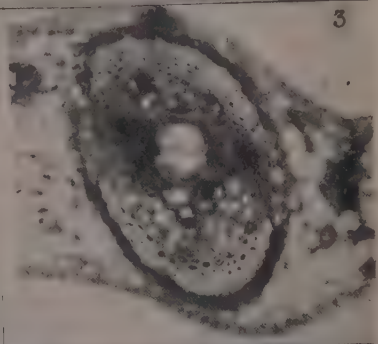
Note the typical gumming disease stripes.
Photo. on Ilf. Rap. Proc. Pan. Plate, with Ilf. Tri-colour Red filter, 16.10.47.

Phot. 6 — Maize leaf from plant inoculated into the spindle with the areca pathogen on 24.9.47.

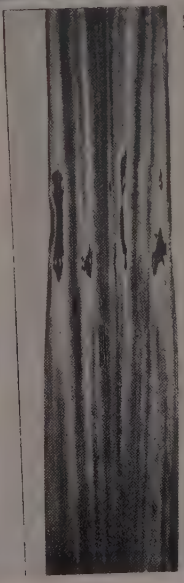
Photo. Ilf. Rap. Proc. Pan. plate with Ilf. Tri-colour Red filter, 9.10.47.

1

2


3

4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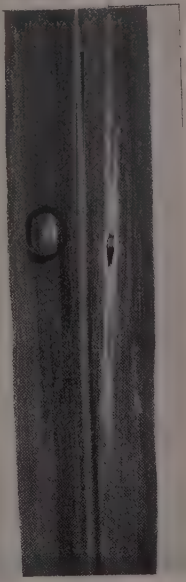

6

to be *Xanthomonas vasculorum* (Cobb) Dowson by inoculation into sugar cane and maize leaves.

Diseased leaflets turn chlorotic and show yellowish-brown veins in the discoloured regions ; affected veins exude gum when examined in water under the microscope.

The drying leaf tissues exhibit a peculiar dappled aspect through the formation of numerous small brown patches. This aspect seems to be characterictic of the disease on the areca nut palm ; it is not exhibited by the two other species of palms, the white palm and the royal palm, already found attacked by the organism in Mauritius.

The slow progress of the disease inside the stem of bud-rotted areca nut palms is taken as an indication of a higher degree of natural resistance to the disease than is the case for the royal and for the white palms.

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RÉSULTATS DU CONTRÔLE BIOCHIMIQUE DES CULTURES DE CANNES POURSUIVI EN 1948

PIERRE HALAIS

Directeur du Laboratoire du "Mauritius Sugar Industry Reserve Fund" — Curepipe

Ce rapport constitue la première vue d'ensemble sur les résultats du contrôle biochimique des cultures de cannes poursuivi par le nouveau laboratoire de l'Industrie Sucrière à Maurice. Le contrôle est basé sur des diagnostics foliaires NPK relevés sur 4000 champs différents de repousses de la variété M 134/32 exploités soit par de grands établissements sucriers soit par de petits planteurs indépendants.

L'acquisition de données aussi nombreuses sur le mode d'alimentation des cultures, dont l'observation avait été retardée faute de méthode d'information accessible, met brusquement à jour des problèmes nouveaux auxquels l'Industrie Sucrière se doit de faire face si elle veut progresser.

Cependant, le contrôle biochimique ne parviendra à son aboutissement en ce qui concerne l'emploi rationnel des engrais qu'après avoir franchi méthodiquement les trois étapes suivantes :

I. *Etablir l'optimum d'alimentation NPK* correspondant à un échantillonnage comparatif déterminé de feuilles, constatation relevant de la Recherche Agronomique et déjà faite par nous en ce qui concerne la fameuse M 134/32 qui occupe aujourd'hui plus de 80 o/o des plantations.

II. *Mesurer le niveau de l'alimentation réalisé en pratique culturale* dans un laboratoire central de contrôle biochimique doté d'un équipement moderne.

III. *Amener les cultures vers l'optimum alimentaire souhaité* en leur fournissant la fumure appropriée, problème ressortissant à l'Economie Rurale.

L'optimun alimentaire est aujourd'hui connu, le laboratoire de contrôle biochimique fonctionne sur une base permanente, il ne reste donc plus qu'à franchir la dernière étape, c'est à dire, à fournir économiquement des engrais aux cultures déficitaires.

I

Nous sommes parvenus à fixer l'optimum alimentaire NPK en suivant trois voies toutes différentes. Les chiffres obtenus concordent fort bien et justifient les aires optimales adoptées comme clé d interprétation du contrôle.

TABLEAU I

Recherche de l'optimum alimentaire NPK.

(3èmes feuilles de repousses de M 134/32 âgées de 5 à 6 mois et en pleine végétation).

D.F. % g rondelles sèches

	Azote N	Phosphate P^2O^5	Potasse K^2O	Remarques :
Optimum relatif	1,52	0,50	1,54	Moyenne générale de tous les champs diagnostiqués en 1947-48 (3997 champs)
Optimum pratique	1,64	0,52	1,63	Moyenne des D.F. sur 57 champs sélectionnés par plusieurs praticiens pour l'excellence de leurs rendements.
Optimum absolu	1,75	0,50	1,50	Interprétation des D F. sur 19 essais comparatifs aux champs sur les engrais, chacun comportant 27 traitements différents: 0, 1, 2 doses de N, de P, et de K.
Aires optimales	1,65-1,85	0,45-0,55	1,25-1,75	Clé d'interprétation adoptée à ce jour pour le contrôle.

Nous avons déjà insisté sur la nécessité d'adhérer étroitement au mode d'échantillonnage prescrit dans la circulaire No. 2 du Laboratoire afin de s'assurer de diagnostics comparables d'année en année et de champ à champ. Il est apparu malheureusement que des échantillons ont été prélevés, dans certains cas tout au moins, en marge des instructions

données, pendant des périodes de sécheresse relative, avec pour résultat l'exagération du déficit constaté en ce qui concerne l'azote. Afin d'éliminer cette source d'erreur, il a été décidé de fixer dorénavant un chiffre minimum de pluie — plus de 3 pouces ou de 75mm — pour la quinzaine précédant l'échantillonnage des feuilles.

II

Les échantillons de rondelles de feuilles ont été prélevés systématiquement d'après les instructions du laboratoire en 1947 et 1948 sur les établissements sucriers (3351 champs de repousses) par les chimistes ou par le personnel en charge des cultures, tandis que les démonstrateurs de la Station de Recherche du Service de l'Agriculture prirent soin des prélèvements chez les petits planteurs (643 champs de repousses). A part les repousses étudiées généralement, 179 champs de vierges furent aussi diagnostiqués (1,65 N — 0,51 P^2O^5 — 1 84 K^2O en moyenne, à l'âge de 8 à 10 mois).

Il n'a pas été possible d'organiser à temps les prélèvements de feuilles chez tous les gros planteurs.

En sus de ces analyses comportant quelque 12500 dosages d'éléments nutritifs, le laboratoire a entrepris de nombreux autres diagnostics foliaires correspondants aux différents traitements expérimentaux sur une quarantaine d'essais aux champs que poursuivent en ce moment la Station de Recherche du Service de l'Agriculture ou les agronomes attachés à différents groupements sucriers.

Toutes ces déterminations analytiques furent faites au cours de cette année, par le Laboratoire de Contrôle à Curepipe, suivant les procédés de microdosages photo-électriques mis au point par nous.

Les résultats des diagnostics se rapportant à chaque champ échantillonné ont été communiqués aux intéressés, accompagnés de la clé d'interprétation.

Le tableau qui suit groupe les résultats du contrôle par district en contrastant les deux différentes formes d'exploitation que suivent depuis des années les grands établissements sucriers d'une part et les petits planteurs indépendants de l'autre.

Le principe statistique utilisé dans le but de condenser les résultats obtenus sur un nombre aussi considérable de champs particuliers consiste à calculer pour chaque district les limites entre lesquelles se situent les teneurs de 50% des champs diagnostiqués — limite inférieure : moyenne moins déviation probable d'un résultat isolé (0,6745 x déviation type), et limite supérieure: moyenne plus déviation probable, autrement dit $m \pm dp$.

TABLEAU II

Résumé du Contrôle sur les échantillons de feuilles prélevés en 1947 et 1948.

	GRANDS ÉTABLISSEMENTS SUCRIERS				PETITS PLANTEURS			
	Nombre de champs diagnostiqués	Azote N	Phosphate P^2O^5	Potasse K^2O	Nombre de champs diagnostiqués	Azote N	Phosphate P^2O^5	Potasse K^2O
		D.F. % g. rondelles sèches				D.F. % g. rondelles sèches		
Aires optimales ...		**1,65-1,85**	**0,45-0,55**	**1,25-1,75**		**1,65-1,85**	**0,45-0,55**	**1,25-1,75**
Districts :								
Pamplemousses & Riv. du Rempart...	*1391	***1,51***	***0,51***	***1,62***	† 128	***1,30***	***0,45***	***1,54***
m ± dp		(1,37-1,65)	(0,45-0,57)	(1,35-1,89)		(1,14-1,46)	(0,39-0,51)	(1,22-1,86)
Plaines Wilhems & Moka	346	***1,52***	***0,52***	***1,46***	49	***1,45***	***0,45***	***1,36***
m ± dp		(1,40-1,63)	(0,44-0,60)	(1,17-1,75)		(1,30-1,60)	(0,37-0,53)	(1,13-1,59)
Flacq	401	***1,56***	***0,53***	***1,63***	227	***1,43***	***0,40***	***1,29***
m ± dp		(1,43-1,69)	(0,48-0,58)	(1,42-1,84)		(1,31-1,57)	(0,34-0,46)	(1,01-1,57)
Grand Port ...	629	***1,61***	***0,50***	***1,40***	143	***1,53***	***0,37***	***1,09***
m ± dp		(1,48-1,74)	(0,44-0,56)	(1,08-1,72)		(1,39-1,67)	(0,30-0,44)	(0,83-1,35)
Savane	584	***1,56***	***0,54***	***1,77***	97	***1,53***	***0,40***	***1,26***
m ± dp		(1,42-1,70)	(0,50-0,58)	(1,59-1,93)		(1,36-1,70)	(0,34-0,46)	(1,00-1,52)
Moyenne	3351	***1,54***	***0,52***	***1,59***	646	***1,44***	***0,41***	***1,30***
m ± dp		(1,41-1,67)	(0,46-0,58)	(1,31-1,87)		(1,27-1,61)	(0,32-0,48)	(1,03-1,57)

N P^2O^5 K^2O

* dont 272 champs chez de gros planteurs (1,54 — 0,48 — 1,58 en moyenne).

† Bon nombre de ces échantillons ont été prélevés en temps de sécheresse d'où exagération du déficit en azote.

Il ressort des chiffres mentionnés ci-dessus :

(1) Qu'en général la meilleure alimentation des cultures se trouve réalisée chez les grands établissements sucriers, particulièrement à la Savane et à Flacq.

(2) Que le manque d'azote se rencontre couramment et un peu partout.

(3) Que le manque de phosphate et de potasse est presque de règle générale chez les petits planteurs des quartiers humides et que, par contre, les terres en bon état d'entretien cultivées par les grands établissements sucriers en sont abondamment pourvues.

(4) Qu'une relation positive étroite existe en moyenne entre les teneurs des feuilles en phosphate et en potasse pour la bonne raison que ces deux éléments nutritifs sont le plus souvent apportés ou négligés en même temps.

Le tableau II, relatif à l'ensemble des districts, est représenté sous forme graphique au diagramme I. Le diagramme II fournissant les résultats plus détaillés du contrôle pour le district de la Savane est donné à titre d'exemple.

Ces représentations graphiques ne doivent être considérées que comme moyen d'expression simplifié de la variabilité de l'alimentation NPK réalisée en pratique à l'intérieur d'un même district ou d'une même unité géographique. Il n'est plus possible d'ignorer cette diversité de champ à champ dans le niveau de l'alimentation alors que l'on dispose actuellement de moyens susceptibles de la déceler rapidement par diagnostic foliaire.

Le contrôle que nous avons institué, et qui consiste à servir l'agriculture concrète dans toute sa diversité afin de guider le choix de la fumure susceptible d'amener les cannes cultivées sur chaque pièce de terrain le plus près possible de l'optimum alimentaire souhaité, nous affranchit des généralisations vagues auxquelles on dut recourir dans le passé. On parviendra ainsi à obtenir économiquement de plus belles récoltes.

En étudiant les diagrammes, il faudra se souvenir que les cannes sur 25 o/o des champs ont de fortes chances de montrer des teneurs encore plus basses que la limite inférieure et que la limite supérieure se trouvera dépassée dans une proportion égale de champs.

III

Les mesures susceptibles d'amener les cultures vers l'optimum alimentaire devront faire l'objet d'un examen attentif vu que, le cas échéant, des améliorations foncières, partant difficiles et onéreuses, seront à entreprendre. Or ce n'est qu'au prix de tels efforts que l'on parviendra pour le plus grand bien de l'industrie en général à relever les rendements chez ces planteurs qui, pour une raison ou pour une autre, ne sont pas encore

parvenus à constituer dans leur sol des réserves suffisantes de phosphate et de potasse pour subvenir à l'équilibre alimentaire qu'exigent les cultures les plus rémunératrices. Par contre, nombreux sont les grands établissements sucriers où aucun sacrifice n'a été négligé dans le passé et où des réserves plus que suffisantes de ces mêmes éléments nutritifs ont pu être constituées. Dans ces derniers cas, il est à souhaiter que l'on y procède aujourd'hui a des réductions sur l'item engrais maintenant que le contrôle biochimique des cultures, placé sur une base permanente, est à même de déceler de façon continue le niveau de l'alimentation des cannes et de sonner l'alarme *bien avant* que le niveau atteint ne puisse avoir de répercussion défavorable sur la récolte.

Le plafond de l'alimentation azotée n'a pas encore été atteint ; une augmentation de l'emploi des engrais azotés est donc à prévoir dès la levée des restrictions.

Sur certains établissements sucriers, surtout chez les annexes, où les réserves en phosphate et en potasse ne sont pas encore parvenues au niveau requis, il faudra procéder sans retard à des améliorations foncières par apport massif de guano phosphaté aux cannes vierges et par emploi judicieux de doses appropriées d'engrais potassiques ou de mélasse.

En ce qui concerne les champs de petits planteurs sur lesquels les diagnostics auront enregistré des déficiences notables en phosphate, le mieux consistera à les planter de nouveau dans un délai aussi court que le permettront les circonstances, l'engrais phosphaté n'étant réellement efficace que lorsqu'il se trouve en contact avec les racines à la suite d'un enfouissement en profondeur. Les apports aux cannes vierges de l'ordre de 500 à 1000 kg de guano phosphaté à l'arpent ne seront pas exagérés pour les champs fortement déficitaires. Par contre, on pourra remédier plus aisément aux déficiences en potasse par apport d'engrais potassique en quantité suffisante, l'emploi de mélasse se heurtant chez cette dernière forme d'exploitation à des difficultés bien connues de transport et d'épandage.

Conclusion :

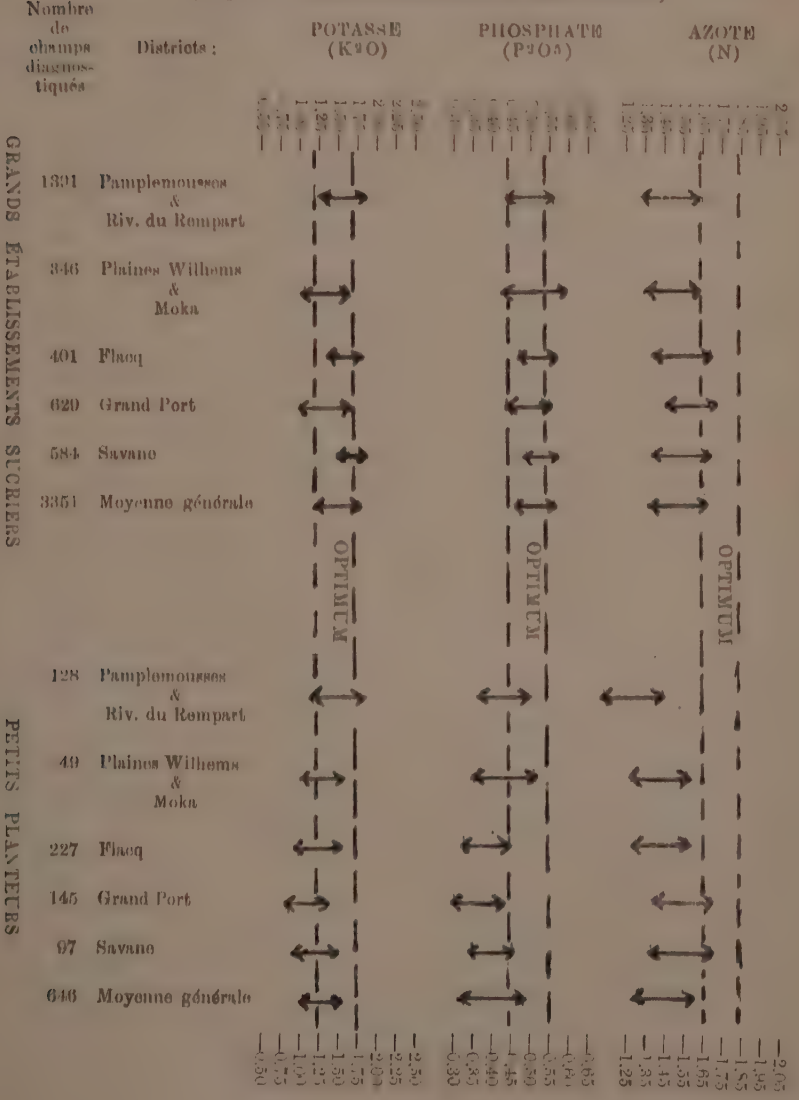
Le contrôle biochimique des cultures par diagnostic foliaire révèle l'état d'entretien des cultures en ce qui concerne particulièrement la constitution de cette réserve phospho-potassique indispensable à l'utilisation profitable d'apports élevés d'engrais azotés qu'exige une canne à haut potentiel comme la M 134/32. Nul ne saurait se passer de ce progrès technique mis à la portée des différentes catégories d'exploitants qui se partagent les plantations sucrières de l'île.

RESUME DU CONTRÔLE BIOCHIMIQUE DES CULTURES DE CANNES (1948)

Diagramme de Variation des Diagnostics sur repousses de M 134/32 en pleine végétation et âgées de 5 à 6 mois.

Limites des teneurs sur 50 o/o des champs diagnostiqués (m ± dp) (o/o g. de rondelles sèches de 3èmes feuilles).

DIAGRAMME I.

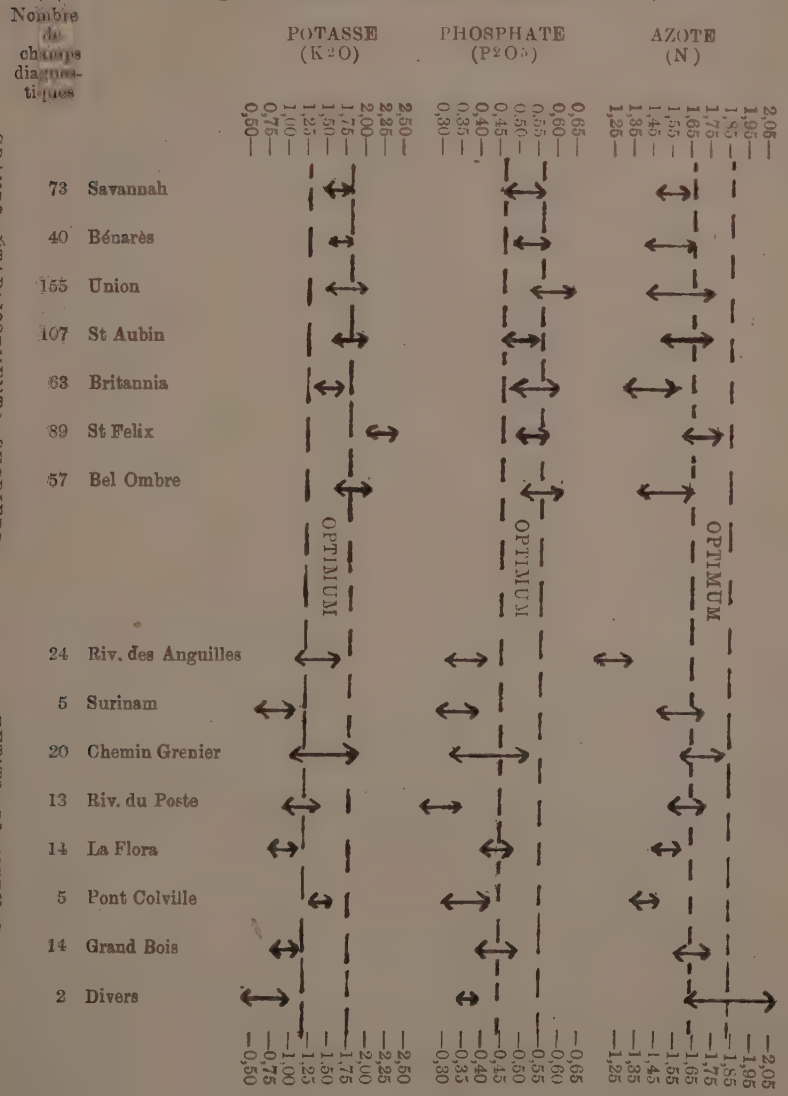


RÉSUMÉ DU CONTRÔLE BIOCHIMIQUE DES CULTURES DE CANNES (année 1948)

Diagrame de Variation des Diagnostics sur repousses de M 134/32 en pleine végétation et agées de 5 à 6 mois

Limites des teneurs sur 50 o/o des champs diagnostiqués (m ± dp)
(o/o g. de rondelles sèches de 3èmes feuilles)

DIAGRAMME II : DISTRICT DE LA SAVANE



THE DEPARTMENT OF AGRICULTURE AT THE OCTOBER SHOW

At the Exhibition held last October at Curepipe, the Department of Agriculture staged an excellent exhibit. The bulk of the public made straight for the model tea factory, a model complete to the last detail and designed to show to all those interested in the development of the local tea industry what a modern tea factory should be. Excellent tea, produced in Mauritius, was served to visitors throughout the duration of the show.

The Sugarcane Research Station had a striking exhibit of the effect of hormone herbicides and sodium chlorate on some of the worst weeds of cane fields such as "herbe Bol" (*Hydrocotyle bonariensis*) "herbe chinois" (*Artemisia vulgaris*), "herbe Solfermo" (*Ambrosia artemisifolia*), "herbe Mackaye" (*Phalaris arundinacea*). Sugarcanes showing potash, phosphate and nitrogen deficiency symptoms, and cane cuttings treated with organo-mercurial disinfectants prior to planting were also shown. Pineapple disease, which sometimes causes serious loss of stools through failure to germinate, is effectively controlled by such desinfectants. The exhibit also contained specimens of the eight principal varieties bred at the Research Station, namely M. 171/30, M. 134/32, M. 112/34, M. 165/38, M. 63/39, M. 76/39, M. 213/40 and M. 423/31.

The model of the No. 2 Humbert scraper, exhibited by the Technology Division, designed to decorticate agave leaves without water, attracted considerable attention. The possibilities of this new machine, which does away with scutching plates and appears to be easily adaptable for automatic feeding, are unpredictable. The problem of an efficient automatic decorticator, which is one of the primary needs of this industry, is receiving a good deal of attention not only in England, but also at the Department of Agriculture where the No 2 Scraper is being constructed for experimental purposes. In view of the research work done in England during the last decade on the utilisation of sisal waste, the advent of this machine, should it come up to expectations, way well prove to be the main factor in the future development of the fibre industry not only in Mauritius but possibly also in other countries.

The Chemical Division had a small exhibit of essential and other oils extracted during experimental work. Samples of hydnocarpus oil, produced by the Division and used in the treatment of leprosy at the Pamplemousses Leper Hospital, were of especial interest.

The Entomological Division had three main exhibits. The first showed

the effects of *Gonipterus* attacks on Eucalyptus species. This pest was introduced into Mauritius about 1938-39 and became a major pest of the plant in 1941-42. In 1946, the egg-parasite, *Anaphoidea*, was introduced from East Africa. It has by now practically subjugated the pest. The second showed specimens of *Clemora smithi* Arrow (better known to cane planters as Phytalus), together with the various parasites introduced from different parts of the world since 1932. Among these were various *Campsomeris* species introduced from Madacascar (1932-36), from South Africa (1937-38), from Puerto Rico (1933 and 1957), from Java and the Philippine Islands (1935-36) and one from Rodrigues (1930), *Scolia* sp. and *Pezopsis pyrrhaspis* Villen. from South Africa and *Typhia parallela* Smith from Barbados. The Division's third exhibit concerned the work so far accomplished towards the biological control of *herbe condé*. Short notes on the various insects shown may be of interest to the planting community.

(a) *Brenthia leptocosma* Meyr — This is only Mauritian insect which appreciably damages *herbe condé*. Its larvae feed on the undersurface of the leaves.

(b) *Lamprosema inabsconsalis* Mosch. — This is a moth, introduced from Trinidad, which feeds upon inflorescences and leaves. It has not yet been released as the extensive feeding tests which must be carried out beforehand have not yet been completed.

(c) *Schematiza cordiae* Barb. — This insect which lives on the foliage of *herbe condé* was imported from Trinidad in 1947. It has a predilection for young conde plants but has been found to be preyed upon by *Podisus nigrispinus* Dall. It is now being reared in the Colony, where 14,000 adults have already been released. It has been found to be breeding in the wetter parts where it is expected to establish itself.

(d) *Eurytoma sp.* — This species destroys seed of *herbe condé* and is obtained from seeds sent from Trinidad. These seeds, however, also contain other small insects some of which are believed to be parasitic upon the beneficial Eurytoma. Eurytoma will soon be released in Mauritius.

(e) *Physonota alutacea* Boh. — This insect, whose native habitat is Central America, feeds on leaves of *herbe condé*. It was introduced here in 1947 and reared at Reduit prior to liberation. Unfortunately local conditions have proved unfavourable and this insect has not been able to breed in the open.

The Tobacco Division had a small display of the best types of cured tobacco leaves produced in Mauritius. A useful graph showed the yearly island consumption of leaf tobacco (imported and locally grown). The

highest production — 400 tons — was reached in 1943 when war-time conditions had created an abnormally high demand ; it is now 330 tons.

The Veterinary Division showed by means of photographs and graphs how milk production had increased at the Government Dairy through the up-grading of local cows by crossing with Friesian bulls.

The Agricultural Division had an attractively displayed exhibit of the vegetable seeds produced annually at the various experimental stations and offered for sale to the public. These seeds which are guaranteed for purity and freshness, germinating capacity and trueness of type, have met with much favour among market gardeners. As a result of the work undertaken since 1943, when the Division first began the improvement of local vegetables by selection, some excellent types of lettuce, carrots, beetroots, French turnips, Chinese cabbages and other vegetables have been produced, while the improved cauliflower is outstanding. Seeds of several varieties of the soya bean and of groundnut were also shown. Potatoes, grown since 1944 from seed carried over from one planting season to the next by means of cold storage, formed a particularly interesting feature in view of the fact that Mauritius imports its seed potatoes annually from Africa, Madagascar, Reunion and Australia. Potatoes raised from such seeds have shown no falling-off eitheir in yield or quality and the work done points the way to the maintenance of adequate supplies of planting material in any future emergency, provided cold storage accommodation is available. Finally, an excellent collection of young fruit trees such as they are produced for sale at Government nurseries, together with a number of decorative palms, in which species indigenous to the Mascarene Islands predominated, contributed its quota of verdure and charm to the Curepipe October Exhibition.

MAURITIUS ECONOMIC COMMISSION 1947-48

THE REPORT OF COMMITTEE No. 3*

Health and Welfare

1. HEALTH

The death rate and especially the infantile mortality rate are high. The main cause of death is in the group of infective and parastic diseases and of these the most important is malaria.

The economic results of the elimination of malaria would be important and a complete reorientation of agricultural work and of the dispersal of the populatiou should be possible. A reorganization of the Medical and Health Department is in process. As regards public hospitals, the present plan is to create three modern central hospitals to serve the Northern, South Eastern and South Western districts. A group of sugar estates in the north of the island has combined to employ two whole-time medical officers and a joint hospital has been built and equipped on modern lines. This is an example of combined effort which is worth following by estates in other areas.

2. WELFARE

There is no social security system in Mauritius which provides for contributions and benefits in respect of invalidity, old age and sickness. The actuarial view has been that the economic conditions in the Colony do not permit of such a scheme being put into effect. With improvement in the net revenue position of the sugar industry, this question is now under serious study. A pension fund scheme for regular employees on sugar estates has been recommended. This is a plan concerned only between private employers and their employees and is not intended to be in substitution of a Government social security scheme. Generally, the tempo of the future advance in social welfare measures depends on raising the educationial and living standards of the people and in ensuring a more equitable distribution within the island of the income of the sugar industry.

Summary of Principal Recommendations

HEALTH

1. One most serious problem in Mauritius is malaria and the large

* Abridged.

scale measures which are programmed should be made known to the population is a clear manner so that the utmost co-operation is received.

2. Malnutrition diminishes the efficiency of the population and increases liability to disease. The importance of beans to the vegetarian section of the population should be more fully recognised and every effort made to increase imports. More serious efforts should be made to deal with the handling of food in shops and restaurants.

3. The Maternity and Child Welfare Organization should be extended to cover all parts of the Colony.

4. Local authorities and estates should be encouraged to establish *crèches* under the care of responsible and intelligent women to care for young children whose mothers are employed during the day.

5. The extension of village councils of a wholly representative character will assist in the solution of local health problems. Steps should be taken through vocational clubs and in other ways to make known the purpose and need of local representative institutions.

6. The introduction of a contributory National Health Insurance scheme should be made the immediate subject for study.

Welfare

1. In a consideration of welfare, regard should be had to a policy of giving first priority to economic development from the proceeds of which funds for social welfare are derived.

2. The Labour Welfare Fund should be used to build up the nucleus of a fund for those who cannot in times of slackness be found public works and who cannot find other employment.

3. The plan between private employers and employees in the sugar industry for providing sugar estate employees with pensions is welcomed as a valuable step and should be followed up by a social security system applying to the whole Island.

4. Co-operative studies should be made of social welfare in Mauritius and other sugar-producing colonies, especially the West Indies, and advantage taken of welfare developments there, of social welfare and educational methods, so that Mauritius will not lag behind tropical countries in social welfare progress.

THE REPORT OF COMMITTEE No. 4*

Labour and employment, wholesale and retail prices, cost of living and wages in Mauritius

Labourers, in Mauritius, work on a time basis or on a task or piece work basis. For such labourers as are not required to work on a time basis, the maintenance of task or piece work is necessary in order to keep up labour output, which in the sugar industry is somewhat low. The average number of hours worked by labourers engaged in the sugar industry was 36 per week in 1947, as compared with 33½ in 1946 and 31½ in 1945. Generally speaking, labour output is the greater, the higher the sugar production, greater output being due almost exclusively to longer hours of work. A recent survey showed that 24 per cent. of monthly employed labourers' households did 21 hours extra work per week and 49 per cent. of daily employed labourers' households did 24 hours extra work per week on home occupations, chiefly cane growing, vegetable growing, rearing of animals, etc. The working party did not consider that the claim of the labour side that task work should be reduced to a 6 hour basis, instead of the present 8 hour basis, would be conducive to efficiency, particularly as the present task was generally completed in much less than 8 hours. The efficiency of the sugar industry necessitates the employment of women and children for certain work in the field for which they are particularly suited but in slack periods men should be given preference. Where women and children perform work equal in quantity and quality to that performed by men, wages should be equal.

As with many agricultural industries, the cane sugar industry makes a seasonal demand on labour and a problem of the industry is the provision of adequate employment in the slack period. There is, therefore, an urgent necessity to develop other agricultural industries of which fibre, tea and the main foodstuffs both crops and livestock are the most promising.

Unemployment is not, as yet, a serious problem in the Island, but there is some seasonal unemployment and under-employment at certain times of the year in certain areas. This is largely the result of maldistribution of labour. In industries other than sugar, unemployment is prevalent among non-manual workers, e.g., clerks and shop-assistants. Data on the incidence of unemployment are insufficient, but the proposed establishment of Labour Exchanges should give a better assessment of the unemployment situation.

The Labour Department was set up in 1938. The Labour Department had been instrumental in developping the principle of collective bargaining for the settlement of problems affecting labour and employers. To maintain continuous and harmonious contact between labour and em-

*Abridged

ployers, the formation of an island Joint Industrial Council on the lines of the South African Industrial Council for the sugar manufacturing and refining industry, is advocated. A Joint Council would be preferable to other possible alternatives. It is generally agreed that in these days emphasis both by employers and by trade unions should be placed on a co-operative productive effort, and the strike weapon should be avoided. The authority of the trade unions would be considerably increased if fewer and larger unions sectionalised for each specialised group of worker were the rule. Good material from the rank and file of the workers should be brought to the surface by better education under the guidance of an experienced Trade Union adviser, or by the appointment to the unions of non government overseas officials as instructors and advisers in modern trade union principles and methods. One of the urgent tasks which calls for investigation is the maldistribution of labour and the acute shortage and low standard of housing in certain overpopulated areas. Control of malaria—on which work is now being actively pursued—and the creation of villages in close proximity to sources of employment are the obvious means of approach to this problem. The present method of recruitment of labour is satisfactory in so far as direct recruitment by estates and through *bona fide* job-contractors is concerned but the recruiting sirdar should be abolished. The estate hospital system has fulfilled a useful purpose and should be continued until such time as a regional Government hospital system covers the needs of all rural areas.

The standard of living of the average labourer has not changed greatly during the war and post-war period as compared with pre-war. Comparison of the wage index with the cost of living index referred to the same pre-war basic period, shows that for manual workers the wage index in 1946 and 1947 has followed fairly closely the cost of living index so that the real wages compare favourably with the pre-war wages. For salary earners, there has been a decrease in real wages.

Wages paid to labourers working in the sugar industry are fixed by collective bargaining, due weight being given to the official cost of living index and to the capacity of the industry to pay.

A way is open for improving somewhat the remuneration of labourers by increasing the purchasing power of their wages through improved marketing and distribution methods. To this end, the co-operative movement recently promoted in this island should be fostered and co-operative principles made known to the workers at periodical collective gatherings. Another method of increasing earnings without any additional burden being placed on sugar producers would be the offer of an incentive bonus for shortening the crop period. Mutual co operation between employers and trade unions should enable the obstacles to such a development to be overcome.

It is in the interests of the labourer, employer and the Colony as a whole, that the industrial associations with responsible leadership be made

representative of the whole labour force of the Island. With this accession of membership, labour should be able to maintain the research work necessary to enable it to present its case with greater efficiency and with results which would contribute to the stability of the industry.

Summary of Principal Recommendations

Labour and employment, wholesale and retail prices, cost of living and wages in Mauritius

1. Employment of the major proportion of workers in the sugar industry should continue to be on a task or piece work basis based on the equivalent of eight hours normal work.

2. Employment of women and children for certain specified field operations is necessary in the sugar industry : for operations other than these, men should be given preference particularly during slack periods.

3. Where the work performed by women and children is equal in quality and quantity to that performed by men, then the wages paid should also be equal.

4. That there is at present a mal-distribution of labour. This should be corrected by the provision of housing in model villages in malaria-free areas closely situated to sources of employment.

5. Steps should be taken to organize the development of agricultural industries other than sugar, particularly food crop production, in order to provide alternative sources of employment and subsistence agriculture. These should, as far as possible, be selected in relation to the labour requirements of the sugar industry.

6. Public works (there is a long period of essential road reconstruction ahead and irrigation needs development) should be put in hand during the slack period in the sugar industry in order to avoid drawing on available supplies of labour for these works during the peak period of employment.

7 Mechanization of sugarcane production should be proceeded with wherever possible, but the industry, in close co-operation with the Government, should see that increased mechanization does not lead to a lowering of wages for hand work, resulting from the offering of lower grade work and should ensure alternative employment to the displaced labour.

8. Trade Union representatives should be empowered to sit as full members of the regional committees in existence for the allocation of work to persons requiring employment.

9. The method recently put into operation for the determination of wages by collective bargaining is the most satisfactory under Mauritius conditions. Full and accurate information on the cost of living index determined by the Statistical Bureau at six monthly intervals, and on the capacity of the industry to pay, should be available.

10. Serious consideration should be given to the possibility of working out a practical contributory scheme to provide old age pensions and health insurance, in order to give some relief to the labourers in commitments towards aged and infirm relatives and to provide for temporary ill-health.

COMMENTS ON THE REPORT OF COMMITTEE No. 4

Labour and employment, wholesale and retail prices, cost of living and wages in Mauritius

This Report provides evidence of the considerable measure of agreement reached by the employers' representatives and the labour side which indicates that a genuine spirit of co-operation and tolerance from both sides is possible. The maintenance of a co-operative spirit and of harmonious relations between employers and employees will, almost more than any other factor, contribute to the future stability of the island. It is increasingly important that with the development of sound trade unionism, the leaders of labour should be in possession of reliable economic information. Until such time as labour can itself arrange this service, the Labour Department should continue to do so.

THE REPORT OF COMMITTEE No. 5*

Co-operative Development

Co-operation was introduced into Mauritius 32 years ago and until recently has been confined to the Raiffeisen credit type. The credit societies have enabled an increasing number of small cultivators to find working capital at reasonable rates of interest. The societies have received the assistance of Government loans, but deposits by members, non-members, loans from other co-operative societies and purchase of shares by members in good sugar seasons, have also assisted in building up the societies. The policy of the Co-operative Department is to remove as much as possible the control and support of Government. The Department considers that the time has come when the movement must learn to stand by

* Abridged

itself. The Department plans to pay off all Government loans in 1948. It is being arranged for societies to secure advances commensurate with their budgetary requirement from a Central Bank operated by the co-operative movement itself. This bank will at first be financed by one of the local banks at advantageous rates of interest. It will also finance the marketing of the produce of co-operative societies and undertake the bulk purchase of chemical fertilizers. It is estimated that the bank will owe its own working capital within ten years. It will also during this time receive the deposits of thrift and saving societies now in process of formation. The Department of Co-operation was formed in 1947 and, in addition to the Registrar's duties under the Co-operative Ordinance, it supervises the operations of the individual societies. The Department has recently promoted an extension of co-operation to the setting up of retail stores and this development has had much success. There are already 30 such stores and it is anticipated that there will be 50 by the end of 1948. All the credit societies sell the sugarcane, maize and tobacco of their members collectively and have done so for the last seven years. A ginger marketing society is now registered. There is scope for greater enterprise in the production and marketing of food and milk in the Colony and steps are now being taken to form two milk marketing societies. There is need to give more emphasis to the educational and social side of co-operation. Little is known in Mauritius of the many-sided character of co-operation, the help it can bring in the development of leadership, the provision of employment and housing and the stimulation which will follow close contact with co-operative organizations in other colonial territories and in other parts of the world. The steady growth of co-operation in Mauritius can well foster the creation of a democratic economy ideally suited to the needs of a thickly populated small island.

Summary of Principal Recommendations

Co-operative Development

1. The priority of attention which has been given by the Department of Co-operation to the development of co-operative credit societies as the basis of co-operative development in Mauritius is regarded as sound and as particularly valuable in assisting the small planters, a category of growers which needs encouragement. It is essential that the credit societies should realise that a great opportunity lies open to them in the present good sugar years, as far as possible, to get clear of Government loans and depend for support on the thrift and savings of their members.

2. Accepting the principle that co-operation is built up on the savings of members and recognising that in the early years it was necessary for

Government to provide the initial finance for the credit societies, it is recognised that the co-ordination of the operations of over 90 co-operative credit societies has called for special measures to be taken. A Central Bank becomes increasingly necessary. Until such time as the Central Bank can be created the aid of one of the local banks will be invoked.

3. The spread of the co-operative movement on the consumer side is welcomed. In due time, the retail stores should be served by a co-operative wholesale store.

4. The credit societies undertake the sale of members' produce, mainly sugarcane, and some maize and tobacco, but co-operation in Mauritius should be developed to include the organization and standardisation of marketing of all marketable agricultural and horticultural produce and fresh fish.

SOUS-PRODUITS DU SISAL*

Des recherches effectuées en Angleterre depuis 1939 dans le but d'utiliser plus complètement les matières premières du sisal — dont la plupart n'avaient jusqu'ici aucune valeur commerciale — ont atteint maintenant un stage où il peut être dit qu'elles ont dépassé les espoirs mêmes de ceux qui les commencèrent.

Les fibres du sisal sont communément employées aujourd'hui pour les cordages de toutes dimensions depuis les haussières de la marine jusqu'aux ficelles, pour les paillassons et pour de nombreuses autres choses en sus de leur utilisation toujours prédominante en tant que matière première pour les cordes employées en grande quantité pour les moissons. Ces fibres sont tirées de l'*Agave sisalana*, une plante aux feuilles effilées et pointues, originaire de l'Amérique Centrale, et qui fut cultivée pour la première fois dans la péninsule de Yucatan, au Mexique, pour la production des fibres. Plus tard cette industrie fut établie sur une grande échelle en Est-Afrique et à Java, et il y a aussi des plantations de moindre importance au Brésil, à Angola, aux Indes Occidentales et ailleurs. Dans les territoires britanniques du Kenya et du Tanganyika de l'Est-Afrique qui sont, à part le Mexique, les régions les plus importantes où le sisal est cultivé, la production de fibre et d'étoupe est d'environ 135,000 tonnes par an. Il y a une production moindre, mais assez substantielle dans la colonie portugaise voisine de Mozambique, et le protectorat britannique de Nyasaland produit aussi quelques centaines de tonnes.

Le sisal prend quatre ou cinq ans avant d'atteindre le moment de la coupe et continue à développer d'autres feuilles ensuite pendant à peu près le même nombre d'années La fibre et l'étoupe que l'on obtient des feuilles du sisal sont environ de 3% du poids total de la feuille avant qu'elle ne soit décortiquée. La feuille est charnue et pleine de sève ; elle contient environ 90% d'eau. Un autre pourcentage de 2 ou 3% consiste en sucre et en acides. Pour récupérer ce sucre et ces acides (bien que la chose soit possible) il faudrait probablement changer la présente méthode de décortication et cette idée peut être abandonnée pour le moment.

L'intérêt immédiat se porte sur les 3 ou 4% de déchet pulpeux rejeté par les machines lors de l'extraction des fibres. Ces déchets sont considérés comme inutiles et embarassants par les administrateurs qui ne savent parfois qu'en faire. Le poids de ces déchets est égal à celui de la fibre et de l'étoupe extraites de la feuille et il s'ensuit que si l'on pouvait les utiliser avec profit l'économie de l'industrie du sisal en bénéficierait de façon considérable.

Il résulte des recherches effectuées en Angleterre pendant les huit ou neuf dernières années que cette industrie pourra probablement bénéficier de cet avantage On s'est rendu compte que la quasi totalité des déchets solides de la feuille peut être utilisée de manière profitable. De

* Note : Extrait du " Times — *Review of Industry* " — March 1948.

plus le tronc de la plante d'où les feuilles prennent naissance, et jusqu'à la fleur produite par la plante à la fin de sa vie si utile, ne doivent pas être considérés maintenant comme un rebut tout juste bon à être brûlé ou utilisé de la façon la moins embarassante. Ces résultats ont été obtenus par un groupe de trente personnes employées par Sir John Ramsden et le Major C. L. Walsh. Les recherches commencèrent à Londres peu avant la guerre, mais continuèrent en 1940 à Bulstrode, la propriété de Sir John Ramsden, près de Gerrards Cross. C'est là qu'elles furent poursuivies sur une échelle réduite pendant toute la guerre, le Ministère des Approvisionnements étant convaincu de leur importance.

Le Major Walsh, qui s'était beaucoup intéressé à l industrie du sisal au Tanganyika pendant la période entre les deux guerres, avait compris, par expérience, la difficulté qu'il y avait à diriger une telle industrie lorsque le prix de vente des produits subit des fluctuations variant, suivant la prospérité des récoltes de céréales mondiales, de £ 16 à £ 45 la tonne. Il s'était rendu compte aussi qu'il y avait certainement quelque chose d'anormal dans le fait que la récupération d'un si faible pourcentage de la feuille entraînait de si lourdes dépenses. Ces considérations inspirèrent ces recherches dont les résultats sont si remarquables.

Jusqu'ici l'expérience commerciale n'a été tentée qu'avec un matériel de modèle réduit à Bulstrode, mais un matériel complet, susceptible de traiter 500 tonnes de déchets par an sur une base de 8 heures de travail par jour, ou 1,500 tonnes en travaillant sans interruption, comme il en a été question, vient d'être installé. On se propose de faire la même chose au Kenya. Ensuite une usine ou, peut-être, deux seront installées au Tanganyika afin de traiter les déchets sur place.

On croit que les usines qui traiteraient 1,000 tonnes de déchets par an pourraient fonctionner économiquement et, de ce fait, il est possible que toutes les grandes propriétés aient éventuellement leur propre matériel afin d'éliminer les frais de transport. Les autres pays où le sisal est cultivé offriront aussi un champ important pour l'extension d'une industrie chimique basée sur cette plante. Il n'est pas douteux, qu'il serait utile de maintenir une base d'expérience et de contrôle au Royaume-Uni où les recherches pour les raffinements et les progrès des procédés, ainsi que l'extension des débouchés pour l'écoulement des produits extraits des déchets provenant des usines d'aloès, peuvent, mieux qu'ailleurs, être menés à bien. Certains produits chimiques sont nécessaires comme réactifs dans les procédés par lesquels les déchets du sisal livrent les précieuses matières qu'ils contiennent. Pour les produire, de nouvelles industries chimiques utilisant les matières premières locales pourraient bien être fondées à l'Est-Afrique et dans d'autres régions où croît le sisal.

Quatre principaux groupes de produits sont obtenus à Bulstrode. Premièrement, il y a une cire qui ne fond qu'à 180° F. et qui ressemble étonnamment à la cire " carnauba " que l'on obtient du Brésil et qui est fort utilisée dans l'industrie électrique. Cette cire, qui représente entre 5 et 6 o/o des déchets du sisal, a un lustre délicat et a été appréciée à Mincing Lane.

Le second groupe comprend les pectines et les pectates représentant environ 12 o/o des déchets. Le pectate de soude est utilisé par les industries de produits alimentaires et pharmaceutiques à la place de la pectine citrique obtenue jusqu'ici de Californie et pour remplacer les alginates, l'agar agar et d'autres substances similaires. D'autres utilisations de ce produit dans l agriculture et l'industrie et des pectates métalliques ont déjà été trouvées ; parmi les débouchés pour ce groupe, on compte la fabrication des cosmétiques, l'industrie du textile et du papier, la clarification des liquides, y compris la bière, les insecticides, etc.

Les acides organiques (tels que les acides malique et citrique), la saponine, les dérivés du glucose et les sucres fermentables forment le troisième groupe. Ils représentent environ 20 o/o des déchets. Un de ces produits extraits à Bulstrode est un excellent anti-corrosif, un autre prévient la formation de " scories " dans les chaudières tandis que les sucres fermentables peuvent être utilisés pour l'industrie de l'alcool et d'autres produits de fermentation.

Le quatrième groupe représente environ 50 o/o des déchets résiduels. C'est en fait le résidu solide après que la cire, les pectates, les acides, sucres, saponines et glucosides aient été extraits et c'est de ce résidu que les acides aliphatiques, comme l'acide butyrique, peuvent être obtenus ainsi que l'acide oxalique, la vanilline et les phénols. C'est aussi une source de matières plastiques (dont on peut se servir pour la fabrication d'objets modelés, articles aussi bons, dit-on, que ceux fabriqués avec d'autres matières plastiques) et de produits utilisés à de nombreuses fins : isolateurs de sons etc.

Il a déjà été question de l'utilisation du tronc et de la tige à fleurs du sisal. Le tronc donne un produit qui a été appelé le bois de sisal. Il ressemble étonnamment au bois de balsa qui vient de l'Amérique du Sud et qui est grandement utilisé, pour l'isolation contre la chaleur humide, comme " enveloppe " des réfrigérateurs et d'autres buts semblables. Il est difficile en fait de différencier le bois de sisal du bois de balsa. Il est moins probable que les tiges trouvent une utilisation loin des lieux où elles croissent, mais comme elles sont légères et résistantes, elles peuvent servir une fois séchées, pour des caisses à claire-voie ou encore, après avoir été fendues, pour des palissades.

Possibilités futures

La récupération, sur une base commerciale, de ces produits chimiques dérivant du sisal, ouvrirait de grandes perspectives aux plantations elles-mêmes. Il se pourrait que dans les années à venir, la fibre et l'étoupe, qui avaient été jusqu'ici les seuls produits mis sur le marché par ces propriétés, passent au second plan, la première place étant prise, à cause de leur prix élevé, par les nouveaux produits extraits de la partie charnue, mais non fibreuse de la plante.

Si cela arrive, d'autres changements se produiront aux usines d'aloës. La difficulté d'extraire l'acide et le sucre de ces feuilles devrait être contournée par un procédé de décorticage à sec.

Un point particulièrement important pour l'économie nationale est que plusieurs de ces produits du sisal, aussi bien que le bois obtenu du tronc de la plante, peuvent remplacer les produits que l'on importe maintenant de la zone dollar.

Ajoutons que des feuilles de furcraea avaient été envoyées aux fins d'analyse à M. G. N. Lepper par l'entremise de M. H. J. Jourdain. M. Lepper écrit à ce sujet : " Bien que les expériences avec les feuilles de furcraea soient encore incomplètes, on peut dire dès maintenant que leur contenu en pectates, et probablement aussi en cire, est à peu près identique à celui du sisal, de sorte que les résidus de l'aloès de Maurice semblent être d'intérêt commercial. Il est possible que ce renseignement intéresse vivement ceux qui envisagent l'expansion de l'industrie des fibres afin de lui permettre de fournir le gros des besoins de la colonie en matière de sacs pour l'emballage du sucre."

La cire dont il est question dans l'article du *Times* est obtenu de la cuticule qui recouvre la feuille d'agave surtout à sa base. On l'obtient en grattant la feuille avec un canif,—c'est du moins la méthode employée actuellement, mais il sera sans doute possible d'inventer plus tard une machine qui grattera les feuilles sans entamer la fibre elle-même.

Si l'on arrivait à récupérer, sur une base commerciale, les produits dont il est question ci-dessus, le décorticage des feuilles devra se faire à sec. On sait que les usines de sisal emploient de fortes quantités d'eau. La nouvelle gratte Humbert, dont on a pu voir une maquette à la récente exposition de Curepipe, offre dans ce domaine un intérêt particulier.

Le 27 août dernier Sir Philippe Raffray, accompagné de M. H. J. Jourdain, a visité les laboratoires de l'African Sisal Products à Gerrad's Cross, dans le Buckinghamshire. Sir Philippe, dans une lettre à la Chambre d'Agriculture, écrit : " Tous les déchets restant après le grattage des feuilles de sisal sont pressés en tourteaux, emballés et envoyés de l'Est Afrique à Gerrard's Cross."

" L'analyse des feuilles de Maurice," poursuit Sir Philippe," fait voir qu'elles contiennent à peu près la même proportion de ces matières que les feuilles de l'Est Afrique. Je crois que nous avons de grandes possibilités dans cette voie et je pense que vous devriez communiquer ces notes au Syndicat et aux producteurs de fibre."

Enfin, notons, de l'article du *Times*, qu'une usine susceptible de traiter 500 tonnes de déchets par an sur une base de 8 heures de travail par jour, ou 1,500 tonnes en travaillant sans interruption, vient d'être installé en Angleterre. Comme l'île Maurice produit à l'heure actuelle environ 1,200 tonnes de fibre par an et une quantité égale de déchets, la construction d'une usine semblable dans la colonie serait du domaine du possible dans un avenir plus ou moins lointain.

REPORT ON THE MAURITIUS FIBRE INDUSTRY

BY G. WINSLOW LOCK, O.B.E.
Senior Agricultural Officer (Sisal), Department of Agriculture, Tanganyika Territory

(CONCLUDED)

V. FACTORS AFFECTING FIBRE PRODUCTION

There is no denying that the Mauritius hemp producer is severely handicapped by many natural and other difficulties, and there are scarcely any factors operating in his favour. These obstacles which have so far largely stultified efforts to produce a greater bulk of fibre more efficiently, are dealt with under separate headings.

The Nature of the Plant and its Fibre

33. *Furcraea* does not yield as well as sisal largely because it grows or unfurls new leaves at a slower rate. It also has a smaller complement of leaves than sisal which means that fewer may be cut off at any one time. The butt-end of the leaf is inclined to be fleshy, especially on young plants, and this, combined with the fine character and low density of the fibre, results in a low fibre percentage. The leaves are also more susceptible to damage. The life cycle of *furcraea* appears to be very variable and the factors affecting poling are not yet fully understood as may be gathered from some conflicting examples given in section II of this report. Under certain environmental conditions *furcraea* produces many more leaves per plant before poling than sisal. The fibre is intrinsically one of the most attractive of the hard fibre class. It is long, fine and soft, but unfortunately these attributes make it difficult to isolate the fibre from the leaf. The relative weakness of the fibre in conjunction with its fineness renders it unequal to the strain of rapid scutching along the entire length of the fibre, such as arises in the standard decorticator for sisal.

Plant Selection

34. It has been mooted that a superior type of *furcraea* might exist in Mauritius as a result of natural pollination or a bud mutant. During my visit a careful watch was kept for possible divergent forms of *furcraea*, and it was concluded that only two clones of *furcraea* exist on the island, viz., *F. gigantea* and *F. gigantea*, var. *Willemiana*. It was also observed that *furcraea* in Mauritius, like sisal in Tanganyika, very rarely sets seed. Thus

it is highly improbable that *furcraea* could be improved through plant selection.

Advantages and Disadvantages of Sisal

35. Some people have considered that the defects of *furcraea* could be overcome forthwith by cultivating another species of fibre agave such as sisal. Sisal possesses the advantages of unfurling new leaves at a quicker rate and has a higher fibre percentage, while the properties of the fibre enable it to withstand mass decortication. About 150 acres of sisal have already been planted in Mauritius, much of which has reverted to congested sucker growth. As mentioned earlier in this report the progress of these plantations was unimpressive and it was deduced that the climatic conditions in the fibre belt are, on the whole, too dry for truly satisfactory growth of sisal. A factor of overriding importance concerns the harvesting of the leaves. Cutting sisal is hard and objectionable work which is unpopular with male labour in East Africa. *Furcraea*, however, is easy to cut and the task can be done by women labour in Mauritius who are very adept at their work. Neither the tip thorn nor the marginal thorns present any serious difficulties to the cutter. It may be fore-shadowed that if the Mauritius hemp industry grew sisal in lieu of *furcraea* this would bring in its train a dire shortage of cutters. In addition sisal fibre, especially that from the later cuts, is heavy and coarse. It is eminently fitted for spinning into cordage but less suitable for spinning into sack cloth. Furthermore, the machinery installed at the Sack Factory is not designed for a hard fibre such as sisal. For the above reasons I am of the opinion that sisal should not supplant *furcraea* in Mauritius even though a means might be found of surmounting the technical difficulties involved in its use.

Blue Sisal

36. Blue sisal (*A. amaniensis*) was introduced into Mauritius a few years ago soon after its discovery in Tanganyika. This species of agave has long, smooth-edged, heavy leaves. The fibre is finer than sisal and both the fibre percentage and fibre yields may be higher than sisal. This erstwhile promising plant subsequently got into disfavour in East Africa largely due to its susceptibility to disease and insect attack. It may be ruled out as far as Mauritius is concerned since the climatic conditions are such that early poling is induced and comparatively few leaves are produced during its life-cycle.

Agave Hybrids

37. The breeding of improved agave plants has been in progress at the East African Agricultural Research Institute, Amani, and the Sisal Experimental Station, Ngomeni, in Tanganyika, for a number of years past. The majority of the new forms are the result of the hybridization of

A. amaniensis and *A. angustifolia*. In general they inherit the characteristics of blue sisal. A number of these crosses hold out some promise in that they are high leaf producers and the fibre is fairly fine, though not as fine as *furcraea*. As and when bulbil planting material becomes available, it might be worth while importing planting material for testing in Mauritius. Such a step could only be in the nature of a trial and several years would elapse before any agave hybrid could be cultivated on a large scale. The utmost precaution must be taken against introducing the sisal weevil (*Scyphophorus acupuntatus*) since this insect displays a partiality towards *furcræa*.

Few of the agaves develop vigorous root-systems in Mauritius, especially during the early years of their life. This makes them liable to be blown over in a cyclone. *Furcraea*, on the other hand, develops a strong and possibly a deep root-system which enables it to become firmly rooted. It also seems able to take up more moisture during the rainy season than sisal.

Climatic Factors

38. Broadly speaking, the climate of Mauritius is almost sub-tropical. The warmest parts of the island occur in the fibre belt, but for long spells the climate is comparatively cool. The average annual rainfall in the fibre belt, taken from 9 Stations, is about 38 inches. Such a precipitation might suffice for satisfactory growth of agaves ; unfortunately its distribution leaves much to be desired. Most of the rain falls during the months of December to March and thereafter a dry period lasting seven to eight months may ensue. This factor, together with relatively low temperatures, militates against sustained growth of agaves such as the grower wants before any quantity of leaf can be reaped per plant per annum. The water relationships of agaves are decidedly important.

Soils and Soil Moisture

39. The soils of Mauritius are of volcanic origin, with minor exceptions. Two main soil types occur in the fibre belt ; the red soils and the "black" soils. There are also intermediate types, yellowish brown in colour which are highly laterised. The red soils appear to be eminently suitable for agaves, the black soils to a lesser degree, while areas of black siliceous clay having a very fine texture in their present from are most unpromising for agaves. Analyses made at the Sugar Research Station indicate that the better soils in the fibre belt are inherently rich in plant food materials. They are defective in that their moisture retaining powers are rather low and this applies with particular reference to the subsoil which contains a considerable proportion of stone and rock. Thus the qualities of the soil do not compensate for the shortcomings of the rainfall.

Stones and Boulders

40. The immature soils of the fibre belt carry with them a vast overlay of stones and boulders. The enormous quantity of stones on the land leaves an unforgettable impression upon a visitor to Mauritius. These masses of stones and rock constitute an impediment of the first magnitude in regard to the cultivation of agaves. It is true that they may act as an excellent soil mulch and that they do not unduly interfere with the growth of an erect crop such as sugarcane, nevertheless, one cannot ignore the fact that masses of rock are a real and serious hindrance in the case of short-stemmed plants like agaves. It would not be an exaggeration to state that but for the stone problem, many plantations of *furcraea* would doubtless have been made long ago. The presence of stones makes it quite impossible to control weeds and to uproot bush ; in addition they obstruct the spreading whorls of agave leaves and hamper cutting or desuckering operations.

Trees and Bush Growth

41. As has been mentioned earlier, a large proportion of the wild *furcraea* is growing under a thicket of semi-deciduous bush. *Leucaena glauca* is wide-spread and it is valued for cattle fodder as well as for the excellent grade of charcoal which it affords. The seed is also collected for feeding to cattle. *Pithecolobium dulce* has its uses for fuel which is scarce on the island. But despite these pecuniary advantages the growing of fibre plants in competition with bush and shade can only be regarded with disapproval. There are good reasons for suspecting that much of the low yields, poor fibre percentages and weak fine fibre which is not amenable to decortication—all faults associated with *fucaea*—is attributable to shading effects. Sisal is a sun loving plant and will not tolerate shade. A common opinion prevails in Mauritius that *furcraea* prefers shade and growers have gone so far as to plant *casuarina* and eucalyptus trees in *furcraea* plantations. Both provide an alternative form of revenue but from the angle of agave cultivation they are undesirable, especially a moisture-seeking tree like eucalyptus. The general belief in Mauritius is that *furcraea* under dense shade produces more leaves and poles considerably later than that growing in the open. This is a question for research though as already recorded open growths of *furcraea* appeared no worse than those under shade. Producers admitted that the fibre percentage of the former was usually higher. Shade may not be the only factor which influences the total production of leaves and it is quite likely that cutting or per-mature withering of the lowest leaves may have more effect. There is no denying that a dense ticket completely excludes any possibility of plantation control.

Obnoxious weeds

42. Herbe condé (*Cordia interrupta*) is the dominant weed in most

stands of *furcraea*. It is a small shurb, seeds freely and can only be kept under control when intensive cultural methods are practised, such as in sugarcane fields. Many hemp producers aver that *herbe condé* is the principal limitation constructed over long distances. The position is reversed in the southern part. Uprooting is expensive and all the main roots must be removed. The difficulties attached to the control of *herbe condé* can be readily understood and the weed is but another of the troubles confronting the hemp producer. Active research work on this problem is now being pursued at the Sugarcane Research Station.

Competition from Sugarcane Cultivation

Sugarcane cultivation is more profitable and less troublesome than growing *furcraea*. The crop is especially suitable for Mauritius. It is no wonder, therefore, that all good land under a satisfactory rainfall, or which can be irrigated, is devoted to sugarcane. Cane cultivation has thus monopolised the best agricultural districts and it is spreading in the fibre belt which is leading to the fragmentation of estates. Only land possessing one drawback or another such as lack of irrigation water, excessive outcrops of rocks, or unsuitable soil, remains available for growing *furcraea*.

Water and Labour Supplies

44. In the northern section of the fibre belt resident labour is fairly plentiful but there is a scarcity of water. Existing water canals have been constructed over long distances. The position is reversed in the southern part. Here water is generally obtainable in ample quantities from rivers, streams or short diverting furrows. Owing to a high incidence of malaria the locality is not densely settled and if workers are required in any numbers it is necessary to transport them daily to and from the healthier uplands ten miles distant.

Fibre Extraction Problems

45. Primitive fibre extraction machinery is the fundamental reason for the tardy progress of the hemp industry to date. Raspadors necessitate the employment of numbers of skilled workers without any corresponding advantages such as a high daily output or excellence of fibre extraction. Their limitations are very great indeed and the most serious of all is the restriction imposed upon output which defeats all endeavour to reduce costs through a high rate of production. An automatic decorticator which will treat *furcraea* on mass production lines has always been and still remains the industry's direst need.

Cost of Labour

46. Judging by East African standards, labour in Mauritius is costly. For example cutting costs are more than double those ruling for sisal in Tanganyika.

Cyclone damage

47. Every agricultural industry in Mauritius runs the risk of cyclone damage. With *furcraea*, the leaves may be broken and torn into ribbons by the force of the wind. The rigid leaves of sisal make it better able to withstand cyclones.

VI. SUGGESTIONS FOR IMPROVING THE CULTIVATION OF FURCRAEA

Experimental work

48. *Furcræa* has not been the subject of a great deal of research until recenty. Two years ago, the Department of Agriculture put down two variety trials and started making routine observations in planted areas of *furcraea* and sisal. The variety trials comparing *furcraea*, sisal and blue sisal, are respectively sited on La Chaumière Estate and in the Botanical Gardens, Pamplemousses. The results of these investigations have provided most useful and interesting comparisons in the growth rates of the three species under Mauritius conditions. All the plots at Pamplemousses have grown faster than those at La Chaumière on account of the better rainfall. The scope of these experiments might well be enlarged by incorporating certain cutting treatments.

Analogy of Furcraea and Sisal

49. *Furcraea* is closely related to sisal and resembles it morphologically. There is justification for assuming that the fundamental principles underlying the cultivation of these two species are basically the same. Thus in formulating improved plantation practices, it would appear to be reasonably safe to apply some of the lessons learnt with sisal in Tangaryika to the growing of *furcraea* in Mauritius.

Preparation of the Land

50. It is imperative to move the masses of stones and boulders which overlay the soil before *furcraea* can be planted at all satisfactorily in Mauritius. The modern bulldozer is specifically designed for work of this nature and is already being employed in this capacity for preparing sugarcane fields. The operation is akin to the reclamation of land for agricultural purposes.

Unfortunately the work is costly ; precise figures are not available but the cost has been variously estimated at Rs. 150 (£ 11.5.0) to Rs. 250 (£ 18.15.0) per acre. Thus a considerable outlay of capital would be involved although this could be classified as a permanent improvement enhancing the value of the land.

Probably the best procedure would be to move the stones for a distance of 40 feet or more with a bulldozer, stacking them into long high piles 8-10 feet wide at the base, leaving broad avenues of exposed soil across the field. In practice, a tractor would require at least 40 feet for working space. An alternative might be found in using an angledozer for pushing the stones to one side and so making a cleared path about 10-12 feet wide.

Granted a favourable piece of land reasonably free of partly buried boulders, ripping could be introduce to remove bush stumps and roots; otherwise a faily large stumping gang would be needed. One or two ploughings with heavy disc-harrow plough would bring the soil into good condition for planting.

The advantages of thorough initial preparation of the land for squat plants such as *furcraea* or sisal cannot be overemphasised. Planting on indifferently cleared land merely accentuates cultural difficulties because the plants themselves hinder subsequent cleaning work.

Planting Material

51. Either bulbils gathered from the poles or bud shoots may be used for planting material. Experience with sisal shows that of the two alternatives, bulbils are preferable even though they require planting in nurseries. Well-raised nursery plants are usually more uniform and better developed than a miscellany of naturally regenerated plants collected from wild growths.

It is advisable to choose a good soil for a nursery and in Mauritius periodical irrigation would be necessary to stimulate growth so that the bulbils should be ready for transplanting after one year. Close spacing causes the plants to become etiolated. The best spacing for sisal nurseries is 20 inches by 10 inches; this was found suitable for *furcraea* in Tanganyika. At this spacing 31,363 bulbils can be accommodated in one acre, eventually giving enough planting material for about 15 acres, using 2,000 plants per acre and allowing for casualties. Bulbil nurseries require a fine tilth and should be clean weeded; anti-soil erosion measures are necessary on sloping land.

Transplanting

52. The nursery plants are ready for transplanting when they have attained a height of 18-20 inches and have a well developed base. Should there be marked variation in size, grading into large, medium and small plants is simply done, each size being planted out in separate but adjoining blocks. This practice contributes to uniform fields and later on greatly simplifies cutting operations, especially at the first cutting.

It is advisable to mark the position of each plant with a short stick when measuring out a field for planting. Trimming the roots and pulling

off a few of the lowest leaves before transplanting is not harmful; this lessens transport costs and makes for easier planting. The plants should be planted as shallowly as possible, just deep enough for the tamped down soil to keep erect. Excessively deep planting may lead to heart rot.

Spacing

53. Spacing is a very important matter for the sisal grower and there is no doubt that it is equally important when planting *furcraea*. The first consideration should be that of population of plants per acre because fibre yields and the life cycle are directly dependent upon this factor. Yields per acre are highly correlated with the total number of leaves cut per acre and this in turn is usually proportional to the number of plants per acre; within limits, the size of the leaf is of less consequence as regards yields. The optimum density of plants is primarily governed by rainfall. As the growing conditions improve so the population of plants may be increased. In Tanganyika the commonest densities used are 2,000 and 2,500 plants per acre, spaced either in single or double-rows. Lower densities are usual in the cooler and drier highlands of Keyna.

There is every likelihood that *furcraea* would obey the same rules as sisal in regard to spacing but the optimum density for different soils and localities can only be determined by trials. *Furcraea*, however, appears to have greater powers for seeking moisture than sisal and if this is really the case more plants may be crowded into an acre. In the young stages *furcraea* is certainly more firmly rooted than sisal, and in the wild state quite large plants may be found growing cheek by jowl in thick clusters. Advantage might be taken of these faculties when planting *furcraea*, for its slower unfurling rate of new leaves, as compared with sisal, could be compensated for by a larger number of plants per acre than would apply to sisal under a similar environment. Thus the total number of leaves reaped per acre might be made more commensurate with that for sisal.

As an illustration of influence of plant density upon yield it may be noted that 1,936 sisal plants producing 30 leaves each annually would give the same number of leaves per acre, namely 58,000 as 2,900 *furcraea* plants producing 20 leaves each per annum.

Regular plantations of *furcraea* in Mauritius have been spaced 5 × 3 ft., or 5 × 4 ft., giving plant populations of 2,900 and 2,178 per acre respectively. These spacings are not ideal; the plants are exposed and there is insufficient space between rows to allow workers to pass without damaging the brittle leaves. The double-row system of planting has many advantages over the simple-row method and can be recommended for *furcraea*. The wide space between alternate rows provides access at all times for weed control, the growing of cover crops, the piling of stones and, if the terrain permits, mechanization of field work. Furthermore, the juxtaposition of the *furcraea* plants in the twin rows would ensure the densest shading effects as early as possible and the intermeshing of the leaves would make for mutual support,

besides acting as windbreaks. This should help to minimise laceration or snapping of the leaves during high winds and might even reduce cyclone damage. The rows should preferably run at right-angles to the prevailing winds.

The following are some examples of double-row spacings—

	Distance in feet	*No. of plants per acre*
(i)	12 × 3 × 3	1,936
(ii)	13 × 3 × 2½	2,178
(iii)	13 × 3 × 2	2,722
(iv)	12 × 3 × 2	2,922

Spacing (ii) has proved very satisfactory for sisal in many parts of East Africa. As regards *furcraea* in Mauritius spacing (i) might be advisable if there were serious doubts about the supply of moisture, but spacings (iii) and (iv) make a greater appeal due to their relatively high plant populations although they would demand a fairly high standard of cultivation for the best results. Since *furcraea* leaves are less rigid than sisal leaves and are not armed with a strong terminal thorn, a distance of 12 feet between the pairs of rows might prove to be adequate working space especially if frequent cutting is practised.

Commencement of Cutting

54. Sisal experiments in Tanganyika have shown that early commencement of cutting contributes not only to improved yields per acre but also to higher percentages in the later cuttings. Early and repeated removal of the lowest whorls of leaves checks the metabolism of the plant and induces it to produce a greater total number of leaves besides postponing poling. The better fibre percentages are brought about through a reduction in the weight of the fleshy butt end of the leaf which functions as a storage organ. The length of the leaf is little affected providing the plant is not cut too drastically or too frequently.

It is conceivable that similar results might be obtained with *furcraea*. The leaf of the first or possibly the second cutting may likely be of no economic value due to the fineness of the fibre precluding its extraction, and it might be left in the field. Such cutting is in the nature of a cultural operation as it enables weeding to be done close to the plants. This is of special advantage in double-row planting where the rows are apt to become overgrown if left unattended for one or two years. There is but little doubt that early and frequent cutting would prolong the life of *furcraea*. In wild *furcraea* it is quite common to see plants with boles of 4-5 feet in height which have probably produced about 300 leaves each without showing any signs of poling. Generally speaking these plants are near roadsides and

they have either been cut regularly or the lowest leaves have withered or been destroyed by fire.

Cutting Cycle

55. In the drier parts wild *furcraea* can only be cut every two years or even less often because of intense interplant competition and the drain imposed upon soil moisture by bush and trees. The Department of Agriculture's investigations show that both young and five years old *furcraea* produce on the average about two new leaves per plant per month, or 29 per annum, there being a flush of growth during the wettest period of the year. With sisal it has been found that the unfurling rate remains fairly steady, apart from seasonal effects, throughout its life-cycle, irrespective of the size or age of the plants. It could be inferred from the above observations that *furcraea* would behave similarly. This implies that a well cared for plantation of *furcraea* could produce enough leaf each year to warrant cutting on a six or twelve months cycle. Since it is envisaged that the crop will be grown on a small scale by each estate, transport of leaf will not be dependent upon the laying of movable rail track. Under these circumstances there is much to be said in favour of light cutting every six months because it would shorten the period over which economic leaf would be standing in the fields. This would help to minimise the risk of damage to the leaf and more especially loss through cyclones.

Maintenance of Plantations

56. Reference has already been made to the rainfall and the moisture holding powers of the soils in the fibre belt which are not altogether satisfactory. Weeding is beneficial to all crops because it reduces losses of soil moisture through transpiration. If rapid and sustained growth of *furcraea* is desired then frequent weeding is essential, more particularly during the first two or three years until the plants are well-established. From this stage onwards they are better able to withstand weed competition by virtue of their deeper and more extensive root systems.

One of the advantages of the double-row system lies in the fact that it is not necessary to practise clean weeding over the entire area. Weeding may be confined to the area between the twin rows and for a distance of about three to four feet on either side. After the first year or eighteen months it is usually only possible to weed on the outside of the rows. Weed growth in the remaining six feet between the pairs of rows may be controlled by periodical slashing or disc-harrowing. The slashed weeds serve a double purpose; they act as a mulch besides adding organic matter to the soil. Once the *furcraea* has reached the bearing stage maintenance work may comprise cutlassing of weeds and bush after each cutting.

The control of "herbe condé" and *Leucœna glauca* in *furcraea* fields will be a formidable problem. It is to be hoped that thorough initial

preparation of the land combined with repeated weeding will help to reduce their nuisance value. These weeds will assuredly grow amongst the stacks of stones and here they might be checked by the use of flame-throwers, which could do no harm on the stones, or else herbicides.

Fibre Yields

57. It is not surprising that there is a dearth of information on the subject of the yield of *furcraea* in Mauritius when it is borne in mind that the bulk of the production originates from uncontrolled wild growths. In the absence of such data reliance must be placed upon observations and measurements of the plant for estimating fibre yields.

The yield of semi-permanent crops like *furcraea* or sisal can be expressed in two ways, namely the rate of yield and the total yield obtained during the life of a plantation.

The Rate of Yield. This is clearly influenced by soil, climatic and cultural conditions. Records of planted *furcraea,* made by the Department of Agriculture, show that the yearly average production of new leaves was 29.4 per plant under a rainfall of 45-50 inches and a plant density of 1,742 per acre. Assuming a plant population of 2,900 per acre and allowing only 15 new leaves grown per plant annually due to more intense inter-plant competition and possibly a lower rainfall, 43,500 leaves would be reaped per acre per annum. In this hypothetical case it could be expected that the plants would be medium-sized, yielding leaves about 140 cms. long. each having a mean weight of 500 grams. Estate figures, taken over several years, indicate that the average amount of fibre extracted from wild *furcraea* leaf is about 2.2 per cent. of the weight of the leaf. Using this figure, the annual yield of fibre works out at slightly less than half a ton per acre. Alternatively, on the assumption that each leaf contains 15 grams of extractable fibre, the annual yield would amount to rather more than half a ton per acre.

These calculations agree with previous estimates of yields provided by experienced producers. Although 0.5 ton per acre per annum is not a high yield it is more than is obtained from mediocre sisal in East Africa.

Some single leaf tests made by me during my visit, with the assistance of Mr. E. Haddon and M. Humbert, showed that a leaf from a two years old uncut *furcraea* plant, 134 cms. long and weighing 980 grams, contained 13.6 grams of dry fibre after 15 cms. of the butt-end had been discarded. The fibre percentage of the decorticated section of the leaf was nearly 2 per cent. Another leaf, 138 cms. long and weighing 435 grams, taken from a smallish but old and regularly cut plant growing in an open and congested stand of plants, yielded 16.8 grams of fibre without the 15 cms. of butt. In this case the fibre percentage over the decorticated part of the leaf was 5.05 and it was probably about 4.5 per cent. for the entire leaf. A leaf from a shaded tall plant, 240 cms. long and weighing

1.5 kgs., yielded 52.9 grams and approximately 4.5 per cent. of fibre without the butt, or possibly 4.0 per cent. overall. Corresponding figures for a sisal leaf from a cut and poling plant, 137 cms. long and 648 grams in weight, were 28.0 grams of fibre and 5.6 per cent. whereas a succulent "malgache" leaf, 159 cms. long and 1.8 kilos in weight, yielded 33.5 grams or 2.6 per cent. of fibre without the butt after repeated decortication due to the thick butt becoming jammed in the machine.

The tests, admittedly inadequate, serve to illustrate that the foregoing estimates are conservative and that considerably better yields might be anticipated if *furcraea* were correctly managed.

The Total Yields. The total yield of fibre obtained per acre depends upon the life-cycle as well as the number of leaves grown per plant. The life of *furcraea* under various conditions is still undetermined, but if plantation *furcræa* can be made to produce a high number of leaves before poling this will have a big effect upon total yields. Tables given in Appendix III show the theoretical total fibre yields for different single leaf weights and different total numbers of leaves cut per plant at two plant populations levels. The percentage of extracted fibre has been kept constant at 2.2 per cent.

Although these tables may be used as a ready reckoner, their real purpose is to show the relationship between leaf-size and the number of leaves cut per plant, upon final yields per acre. There will be a tendency for the leaf to become less heavy as the plants are induced by cultural methods, such as spacing or cutting, to produce more leaves, therefore the tables should be read diagonally beginning on the left-hand side and progressing upwards. A typical example, certainly for sisal in Tanganyika, would be that of a plant population of 2,500 per acre yielding 180 cut leaves per plant each averaging 700 grams weight which gives a total fibre yield of 6.93 tons per acre. If these plants should yield 200 cut leaves but their weight decreased to 600 grams each, the total yield would be 6.6 tons, and to go one stage further, if they yielded 220 cut leaves weighing only 500 grams, the total yield would be 6.05 tons per acre.

Inspection of these tables, coupled with some knowledge of *furcraea*, suggests that the total fibre yield per cycle might vary between 5 to 7 tons per acre. This compares favourably with sisal yields, and, of course, *furcræa* would surpass sisal if it yielded many more leaves. Such an increment in total yield would help to offset the greater expense attached to planting *furcræa*.

VII. EXTRACTION OF THE FIBRE

58. The question of fibre extraction did not come within my terms of reference because a consulting engineer versed in decorticating machinery had been engaged to study existing methods and to advise upon their improvement. It is, however, of such crucial importance that no review of

the Mauritius Hemp Industry would be complete without some mention of the subject.

59. As stated previously, Mauritius hemp is extracted from the leaves by raspadors. A raspador comprises three wheels spaced and keyed on to a shaft. Each wheel is 20 inches in diameter and has a $2\frac{3}{4}$ inches face to which 20 angle-iron "knives" or scrapers are bolted, each knife being 20 inches long by 1 inch high. The drum revolves at 1,100 revolutions per minute and beats and scrapes the leaf downwards against a bronze breast plate which has a face 2" wide. The breast plate is adjustable and the distance between it and the knives varies from $\frac{1}{4}$ to $\frac{1}{8}$ inch. The whole is encased in a semi-circular box which has an aperture $8 \times 1\frac{1}{2}$" just above the breast plate through which the leaves are inserted by hand.

60. There are usually two "gratteurs" or operatives per raspador who feed the leaf from either side of the machine. The man on the right-hand side has to pull the leaf out with his left hand guiding with his right-hand, and conversely for the man on the other side. Thus left-handed and right-handed workers are needed. Between the two is a wooden table with sides upon which the leaves are placed by an assistant, usually a juvenile. Gripping the leaves is hard upon the hands and the leaf juice causes smarting and irritation to the skin, so the hands of each "gratteur" must be protected by stout leather gloves and the arms by a piece of stocking or sacking. Gloves are quite a costly item of production.

61. Big leaves can only be fed one at a time but with smaller leaves the "gratteur" often inserts two leaves, one superimposed upon the other. The butt end is put in first and some force is required before it will pass between the knives and the breast plate; frequently a thick butt end has to be scutched on one side side for 6 inches, withdrawn, turned over and inserted again, this time up to approximately half way down the leaf; sometimes the butt has to be smashed with blows from a wooden mallet. It is then pulled out and the blade end of the leaf is introduced and withdrawn. The scutching of the fleshy butt half of the leaf may therefore take three times as long as scutching the blade. When working, the raspadors are noisy, giving a high pitched note.

62. The scutching is very imperfect and the fibre is green with adhering pieces of broken epidermis and parenchyma. Often the central part of the leaf may not be decorticated at all. The butt end fibres are usually macerated into a soggy, woolly mass due to prolonged beating, and the other fibres are tangled or knotted. Better scraping could be obtained if the breast plate was set closer to the knives but waste losses would be higher and it would lead to dissatisfaction amongst the "gratteurs" since their work would be harder and their output of green fibre would be lower. The task system in force puts a premium on bad scutching.

63. Each gratteur is paid at the rate of Re. 1.00 per 100 kilos of green fibre. Individual outputs vary according to skill, from 250-400 kgs. per day (7 a.m. to 3 p.m.) Fifteen scrapers might give an output of 3.25 tons

of green fibre in a day. Weekly outputs of dry fibre vary from 1.5 to 3 tons depending upon raspador capacity and the attendance of gratteurs. A comparison of these outputs with a sisal decorticator delivering the equivalent of half a ton of dry cleaned fibre per hour, or 1,500 tons per annum, suffices to illustrate the limitations of raspadors.

64. Several attempts have been made in Mauritius to design automatically-fed raspadors and a few descriptive notes are given about each type.

The Raffray Decorticator

65. This machine comprises two raspadors working against an adjustable sprirg-loaded breast plate. Each raspador has its separate feeding mechanism consisting of a series of heavy jaws attached to endless moving chains. Two leaves are placed length-wise in a trough, gripped at the butt-end by the jaws which carry them along to the raspador withdrawing them on the return journey. Six to seven inches of butt remain undecorticated and these butt-ends are later deposited on a flat platform when the grip of the jaws is relaxed. The fibre hangs down and is picked up by another set of lighter bronze jaws travelling on a second chain ; the butt-ends are carried along and fed crosswise into a small decorticating drum.

The scutching of the blade of the leaf is generally better than that on a hand-fed raspador. The butt end fibres are severely crushed and emerge warm, due to friction heat, from the final drum. This fault might be remedied in the light of experience with sisal decorticators and the amount of fibre lost in the waste could probably be reduced.

The greatest virtue of the Raffray machine is that it gives a relatively high output of about 600 kilos of dry fibre daily. It is also possible to dispense with skilled " gratteurs " and fermentation in tanks is unnecessary. The end results, however, are far from perfect and the machine has too many moving parts.

The Robey-Souchon Raspador

66. The single raspador of this machine is 2'-6" in diameter to which is fitted 40 angle-iron knives $1\frac{1}{4}$" high, spaced $1\frac{3}{4}$" apart. It runs at a high speed cleaning the leaf against an adjustable bronze breast-plate having a face 5" wide. Leaves are fed singly, tip first, through a pair of fluted rollers, the upper roller being heavily weighted. The leaf is not withdrawn and so passes straight through the rollers. The scutched fibre, emerging from the lower side of the breast-plate, is gently pulled away from the suction of the drum by a six-bladed revolving paddle and finally by an operator collecting the fibre.

The machine is well-constructed. It cannot be said, however, to give clean decortication. The leaf is merely crushed and there is no scraping

action because the leaf is not withdrawn. Waste losses are small, except that it is necessary to cut off 4-5 inches of the pulverised butt end which cannot be scrapped once it leaves the grip of the rollers.

An extraction of 2.72 per cent. of the weight of the leaf is claimed. The daily output of dry fibre is about 165 kgs.

The Humbert Raspador

67. This machine is only in the pilot stage and the present model naturally has many mechanical imperfections. Its design is rather complex. Instead of using the conventional raspador and breast plate, the fibre is extracted between two revolving drums set about $\frac{1}{4}$ inch apart at their tangential points. Each drum is 12 inches in diameter and is fitted with 13 knives of two inches in height. Both run at the same speed 1,100 revolutions per minute. Leaves are fed by means of 6-foot diameter wheel which has diametrically opposed toothed, spring-loaded gripping devices, the leaves being gripped at the butt-end. They are held to the circumference of the wheel by a travelling belt and two other belts serve to guide the tip of the leaf into the gap between the two drums, besides carrying away the waste pulp. The fibre, together with 6-7 inches of undecorticated butt, is delivered on a slow-moving belt. On a good working day the output is 175 kgs. of dry fibre.

The Humbert machine is interesting in so far that it is the only one which truly isolates the fibre in its pristine condition. It points to a correct principle in decorting *furcræa* leaves.

General Remarks on Decorticating Mauritius hemp

68. About half the cost of producing Mauritius hemp is absorbed in extracting the fibre. Present processes are too many and much too slow. Higher fibre output rates would have far-reaching effects. The fibre could be produced at less cost, the annual turnover would be increased, and planting on a large scale would be justified.

The superiority of the sisal decorticator over the raspador lies in the fact that the leaves are fed into the machine crosswise and not endwise. This means that vast quantities of leaf can be dealt with rapidly and the fibre is mass-produced. Such methods are possible with sisal because it will withstand the strain of momentary crushing and scraping along the entire length of the fibres.

Mauritius hemp is considered to be unequal to such strain due to its fineness; trials made with a sisal decorticator years ago are stated to have been unsuccessful. Yet the advantages of a cross-fed decorticator appear sufficiently great to warrant deeper consideration being given to the design of the drum wheels particularly as to their weight, speed, and the number and shape of the knives. These features might be modified so

as to reduce the pulling force exerted on the fibre. It is hard to conceive that the cleanliness of decortication could be of a standard lower than that of raspadors ; in any case perfect decortication is not essential for the present end-use of Mauritius hemp.

The Humbert principle of decortication appears worthy of further development, particularly if the leaf could be fed crosswise and the length of undecorticated butt could be reduced to a minimum. The action of the raspador is to impose a relatively light force progressively upon short lengths of fibre. Much of the disruption of cellular tissue occurs when the fibre is licking the edges of the raspador blades before withdrawal for the scraping process. This does not give a positive pull ; thus cut or broken fibres are largely obviated.

For the present the industry does not require an unduly large or expensive machine. A suitable type would be one which could be constructed locally from ordinary sectional steel, possibly embodying certain standard parts which are available from existing makes of detorticators.

VIII. UTILIZATION OF THE FIBRE

The chief attributes of Mauritius hemp are its fineness and softness. The fibre is also white and of good length.

Fibre fineness may be expressed in terms of the mean weight in milligrams per 10 centimetres length of a single fibre In the case of sisal this figure corresponds very closely to that for the percentage of extracted fibre to weight of leaf. For example, first cut sisal having a fibre percentage of 2 5 will usually have a fineness figure slightly lower than 2.5, while older sisal which has been cut regularly may have a fibre percentage and a fibre fineness of approximately 4.0 or higher. For comparison, some tests made at the Sisal Experimental Station, Ngomeni, on a sample of Mauritius hemp indicated that its fibre fineness is about 2.0 rising to 3.0 for the longest and coarsest median fibres. The softness of Mauritius hemp is attributable to its fineness combined with the fibriles having relatively thin walls and consequently a correspondingly larger lumen. This results in Mauritius hemp being less dense than sisal, although both fibres are chiefly composed of cellulose, and a given weight of it will spin to a greater length than sisal. Moreover the butt ends are not harsh like those of sisal which give trouble during spinning and lead to a wkiskery yarn.

Broadly the system used for preparing the fibre at the Sack Factory resembles that employed in a jute mill. The raw fibre is first cut up into short lengths to suit the 20-25 inches reach of the drawing frames. It is subsequently cleaned of cortical tissue in carding machines and a sliver is formed from a towy mass of short fibres. These methods differ from the orthodox system of spinning " line " fibre, such as sisal or manila,

into yarns for twines and ropes. Before sisal can be passed over the machines at the Sack Factory it is necessary to cut it into short lengths.

For weaving sack cloth, the Sack Factory spins two types of yarns from Mauritius hemp. Warp yarns are spun to 2,000 yards to 1 kg., equivalent to approximately 3.3 lea (1 lea equals 300 yards per lb.). Weft yarns are twice as heavy being 1,000 yards per kg. or about 1.6 lea. These are fairly fine yarns and during weaving 6 shots are used per inch of cloth. Sisal fibre, on the other hand, is mostly spun into coarse yarns, 550 ft. per lb. (0.6 lea) and in practice it is difficult to spin it lower than 1.25 lea. The Sack Factory has spun sisal to 1.1 lea.

The standard Mauritius sugar-bag will hold 55 kgs. of sugar. The finished bag weighs 700 grams but after allowing for industrial loss, comprising mainly 15 per cent. of dust, 800 grams of raw fibre are required to make one sack. At its present capacity the factory can consume 800 tons of raw fibre annually which, at the rate of 1,225 bags per ton, will make nearly a million bags. The total requirements of the sugar industry amount to 6,000,000 bags which would necessitate a minimum supply of 5,000 tons of raw fibre.

The Sack Factory works under the aegis of the Department of Agriculture and the governing body has had the foresight to order twelve more looms which are expected to arrive about the end of 1948. Once these are installed the factory will be enabled to run the preparing and spinning machines for two shifts or 16 hours per day, using male labour. Women are more adept than men at operating the looms but they may not be employed on night work, but with the extra looms, running 10 hours per day, it will be possible to increase the output of the factory to over 1,400.000 bags. Its consumption of raw fibre would then be 1,200 tons per annum.

Heavy filter press cloth is also manufactured for the sugar industry. This fabric is woven from a Mauritius hemp warp and a sisal weft using nine shots per inch. 80,000 yards of widths varying from 27-42 inches were made during 1947. The cloth has proved eminently satisfactory for the needs of the sugar industry.

Questioning of sugar producers elicited no complaints whatever about the locally-made sugar bag which was found to be satisfactory in every respect and which commands a second-hand value greater than that for gunny bags. Both the management of the Sack Factory and the standard of its products deserve every praise.

The foregoing account of the operations of the Sack Factory illustrates that sisal fibre would be unsuitable for the present equipment as well as for making bags. Sisal cloth is too heavy and stiff and it is difficult to obtain a close weave without heavy calendering. Some of the agave hybrids mentioned earlier have given fineness figures of about 2.2 which is only a little coarser than Mauritius hemp. They have one drawback, however, and that is that the butt-end fibres are inclined to be

harsh. This might be overcome to some extent by cutting the fibre into short lengths and preparing a sliver from a tow, as at present.

I am indebted to Mr. A. M. Souchon, Manager of the Sack Factory, for many of the details given under this heading.

IX. RESEARCH

Furcraea is generally compared unfavourably with sisal largely because it is reputed to have a lower fibre percentage and there has been a tendency to overlook some of its attributes. The discussion in Section VI of this report contains a number of pointers which suggest that higher fibre yields per acre as well as more favourable fibre percentages might result if a better understanding of how to manage the crop could be obtained.

A modest programme of experiments could contribute much towards knowledge of *furcraea* cultivation. In practice a great deal will turn upon ascertaining the factors affecting the deferment of poling and how to induce the plant to produce a large number of leaves. The low percentage of fibre associated with *furcraea* is questionable and it could possibly be improved by different cutting methods. The important relationship between plant population and yields per acre needs to be determined. Many of these questions could be answered within the compass of a single spacing × cutting trial. The necessity of shade for *furcraea* requires to be elucidated in a separate experiment while a third trial could deal with planting and cultivation methods.

Given the co-operation of the industry, it should be possible to carry out the field trials mentioned above. A part-time experimentalist might be employed for this work under the direction of a senior officer of the Department of Agriculture.

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G. W. Lock,
Senior Agricultural Officer (Sisal).

Sisal Experimental Station,
Mlingano, Ngomeni,
Tanganyika Territory.
6th December, 1947.

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STATISTIQUES

1°. CLIMATOLOGIE

(a) Pluviométrie (Pouces)

Localités / Mois	Nord						Centre					
	Pamplemousses Gardens	Pamplemousses (Normale)	Abercrombie	Abercrombie (Normale)	Ruisseau Rose	Belle Vue Maurel	Beau Bois (Moka)	P.W.E.S.	Réduit	Réduit (Normale)	Curepipe	Curepipe (Normale)
Septembre	1.58	1.83	1.01	1.65	2.44	—	6.38	8.00	3.07	1.71	9.37	5.78
Octobre	1.48	1.95	1.76	1.11	0.39	—	3.51	6.72	1.68	1.91	4.42	4.52

Localités / Mois	Est				Ouest					Sud			
	Centre de Flacq	Camp de Masque	Palmar	G.R.S.E.	Port-Louis	Case Noyale	Beau-Bassin	Beau-Bassin (Normale)	Richelieu	Rose Belle	Riche-en-Eau	Camp Diable	Chemin Grenier
Septembre	3.03	1.63	2.66	2.09	0.71	2.44	1.18	0·85	0.70	8.00	—	3.59	3.64
Octobre	5.00	2.22	2.86	1.97	1.01	0.39	1.46	0.85	0.81	6.72	—	4.89	3.42

(b) Température °C

Localités	Beau-Bassin		Réduit				Curepipe		Richelieu	
Mois	Max.	Min.	Max.	Min.	Moy.	Nor.	Max.	Min.	Max.	Min.
Septembre	23.4	16.1	22.9	15.9	19.0	18.7	20.5	15.6	26.2	19.3
Octobre	24.6	17.9	24.2	17.1	20.2	19.9	22.0	16.3	27.0	20.2

(c) Insolation

Réduit		
Mois	Heures de soleil	Fraction d'insolation
Septembre	218.33	60.9 %
Octobre	223.13	57.6 %

2° Revised Forecast of the 1948 Crop

Weather conditions during the ripening season have been very favourable with regards both to temperature which has been low and to rain which has been scanty. This will result in a percentage extraction higher than that expected, probably reaching an average of 12.35.

2. Cane yields in the fields are also proving to be higher than previously estimated.

3. In the light of the above facts, it is necessary to revise the figures given in the preliminary forecast. The revised forecast shows that the crop will amount to 384,000 metric tons compared to 358,000 tons in the former one. Distribution by district is given in tabular from below, which also includes the yield of the preceding five years.

(Unit : 1000 metric tons)

Districts	1948 Forecasts		1947	1946	1945	1944	1943
	Revised	Preliminary					
Pamplemousses	41.16	37.50	37.33	86.70	41.71	57.60	77.64
Rivière du Rempart ...	56.28	48.77	50.02				
Flacq	62.93	57.81	50.36	41.29	21.05	29.98	45.74
Moka	36.37	36.33	39.20	31.15	15.47	23.97	40.29
Plaines Wilhems	30.04	28.85	30.81	23.08	10 18	14.85	23.42
Black River ...	17.70	17.25	14.43	11.12	6.61	8.47	13.49
Savanne (*) ...	79.00	74.93	59.32	47.39	22.04	33.95	55.71
Grand Port (*) ...	60.67	56.15	67.06	50.33	21.99	30.82	54.43
Total ...	384.15	357.59	348.53	291.06	139.05	199.64	310.72

(*) Figures for Savinia (Grand Port) are included in Savannah (Savane).

J. R. L.